Assessing the Interaction and Interactivity in OUT-MOODLE LMS: *The Outlook of Content Design Patterns, System Configurations and User's Access Rates*

Mr. Said Ally

Dept. of Information and Communication Technology (ICT)

Faculty of Science, Technology and Environmental Studies (FSTES)

The Open University of Tanzania (OUT)

PO Box 23409, Dar Es Salaam, Tanzania

Tel: +255 784 340 315 / +255 714 715858

E-mail: saidallymasomaso@gmail.com / said.ally@out.ac.tz

Abstract

Despite the wide spread adoption of MOODLE by Higher Learning Institutions (HLIs) in Tanzania, there is still lack of maximum utilization of the software by learners. This is due to lack of interactivity in the system caused by poor MOODLE customization and configuration, improper content design and integration with add-on multimedia files. On the other hand, instructors consider that uploading learning materials in MOODLE is enough without putting down the interactivity facilities.

This paper assesses the interactivity in MOODLE from both design and usage. The paper discloses the extent of poor MOODLE customization that can likely hinder the inclusion of the multimedia facilities, extent of poor online course design and lack of virtual interactivity among learners.

To undertake this study, a case study methodology was opted by investigating the MOODLE platform of the Open University of Tanzania. The respondents to this study were categorized as MOODLE Learners (MLs), MOODLE Instructors (MIs) and MOODLE Administrators (MA). In addition to interview, an intensive documentary review together with screening the design and configurations of MOODLE servers has been done. The study focused on four aspects of interactivity which are learner interaction to learner, instructor, content, and interface.

The study reveals that there is a critical lack of interactivity between learners themselves enrolled in the same course, between learners and their respective tutors and between learners and system contents and interfaces. The synchronous interaction is less practiced compared to asynchronous interaction. This has been due to less insertion of real time multimedia and interactivity features.

Generally, uncoordinated operations and ad hoc performance among key MOODLE stakeholders during interface design, software implementation, system configuration, and onsite content development form the basis of this.

Keywords: Learner, Software, Content, MOODLE, Interaction, Interactivity, HCI

1. Introduction

Online learning has become an increasingly popular venture for higher education institutions in Tanzania with MOODLE as Learning Management System (LMS) leads the way [1]. The MOODLE (short for *Modular Object Oriented Dynamic Learning Environment*) is robust software available with free open source codes under the GPL license [2, 3]. This software has attracted and captured the attention of most of the educator's community (>300,000 registered users, 30,000 sites translated into over 70 languages) with main reasons being the existence of inbuilt virtual learning features and well-articulated educational philosophy [4, 5]. Through its HTML editor, instructors are provided with a range of formatting tools useful for content creation. Based on its design, MOODLE can organize and disseminate learning materials in a systematic, systemic and interactive matter either synchronously or asynchronously.

The Open University of Tanzania (OUT) shifted from ATutor to MOODLE in 2008 and acquired an e-learning implementation strategy in 2011 [6, 7]. However, the rate and level of interactive and interactivity among learners, instructors, contents and interfaces are not promising. Interaction is crucial to learner satisfaction and can be achieved by adding synchronous components designed with multimedia features suitable for online courses.

Therefore, the study aimed at evaluating the interaction and interactivity in MOODLE platform from system and user's perspective with main focus on the design and implementation of synchronous virtual learning features, learner-learner interaction, learner-instructor interaction, learner-content interaction and learner-interface interaction. The study discloses the interactivity gaps so that MOODLE adopters may decide to bridge and maximize the benefits of it.

The remainder of the paper is organized as follows: section 2 presents the theoretical part of Human-Computer Interaction and MOODLE interactivity. Section 3 presents research setting and methodology. Section 4 is for findings and discussion. The last part (section 5) formulates the concluding remarks for further work.

2. Literature Review

There is a dramatic growth of software technology that facilitates interaction and interactivity in education systems. The interactive learning (*also called active learning*) is done through LMS and is considered as field of Human–Computer Interaction (HCI). MOODLE is user friendly GUI-LMS, easy to use software and possesses distinctive features better for the implementation of HCI and contains all standard LMS components as described by [8].

Despite the fact that ease of use is one of the criteria which facilitate user adapted interaction in MOODLE as argued by [9], however, there are several other characteristics suggesting future of HCI as pointed out by [10]. These characteristics include *ubiquitous communication*, *high-functionality systems, mass availability of computer graphics, mixed media (images, voice, sounds, video, text, and formatted data)*, *high-bandwidth interaction, large and thin displays (lightweight and low in power consumption) and information utilities.*

The [11] identified interaction as a defining and critical component of the educational process where the

interaction between instructors, learners and content occurs in all forms of education. Interactivity in a Virtual Learning Environment (VLE) is defined as the art of instigating interactions and facilitating communication between leaning objects (LOs) and learners [12]. So, basically interactivity initiates interaction.

2.1 Defining Interaction and Interactivity in LMS

In a web system like MOODLE, interaction is based on instructional media and can occur synchronously or asynchronously [13]. However, there is no common definition for interaction exists in the educational literature [14]. As stated by [15], some of the dimensions that comprise the concept of interaction include communication, collaboration, and active learning. The [16] has developed a much more broad definition of interaction as the learner's engagement with the course content, other learners, the instructor, and the technological medium used in the course.

The two terms interaction and interactivity are sometimes used interchangeably. However, [17] made a distinction between interaction and interactivity. According to [18], interactions "occur when objects and events mutually influence one another while interactivity appears to emerge from descriptions of technology for establishing connections from point to point in real time. The gap is that the interactivity applies technology used in learning while interactions describe behaviors of learners and groups.

From its origin, MOODLE has been designed to be interactive web based LMS software which facilitates interactions among learners themselves, learners and instructors, learners and contents and between learners and software (interface). The learner-learner, learner-instructor and learner-content interactions can be found in both traditional classrooms and web based courses. The learner-interface is totally based on the courses offered through web LMS system and can have a tremendous bearing on students learning the content [19].

The three modes of interaction were discussed by [20] across the spectrum of distance education formats i.e. student/teacher, student/student, and student/content. In terms of ranking of the interaction types, [21] states that learners show that their interaction with themselves comes in first, then with the instructors and finally with content.

2.2 Learner-Learner Interaction

As argued by [20], the learner-learner interaction includes communication among classmates for the purpose of completing a course related activity and informal discourse about class subject matter. In web LMS like MOODLE, for effective learning to occur, there must be participation, response, provision of affective feedback, and short, focused messaging among learners.

2.3 Learner-Instructor Interaction

The learner-instructor interaction can take the form of face-to-face exchange between teacher and learner, as well as both synchronous and asynchronous digital communication in online or blended settings. This

type of interaction is intended to help reinforce student understanding of the course. In web LMS, most often this type of interaction is transmitted by electronic means, such as chat rooms, messaging or e-mail communications where the instructor becomes more of a facilitator [22]. The quality and timely feedback is more paramount in web LMS as since the learner-instructor lacks face-to-face interaction.

2.4 Learner-Content Interaction

The learner-content interaction refers to student engagement with course resources. The [20] defined it as the process of intellectually interacting with the content with impacts in learner's understanding. To Moore, there is no education without student/content interaction. This interaction results from students examining the course content [23] and from participating in class activities.

The factors which affect the learner-content interaction include the continuous contact with the content [24]; clarity of course design [25]; time [26]; participation in online discussions [27]; and mode of delivering course content [28].

2.5 Learner-Interface Interaction

The learner-interface interaction refers to the interaction between student and computing tool (*for this case, MOODLE*) in learning process. The technological tools themselves are neutral [29]; therefore, the manner in which students interact with the technology is what impacts on their learning. Some factors that affect the learner-interface interactions include ICT literacy and computer experience, perceptions on technology, and access to technology. The [30] claim that the experience of computers can affect the student learning in a web LMS. The complexity in interacting with the technology in web LMS may lead students to view technology negatively, and so affecting their learning process. The learner-interface interaction also depends on the student access to technology [31]. The interaction between learner and interface also depends on the design of the web LMS.

The extent of functional MOODLE implementation that can offer a high degree of interactivity has not been established and the primary interactive features are underutilized. Therefore, because of the proliferation of MOODLE adoption, online contents and the differences in interactions, a vital need exists to assess the effectiveness of interactivity in a MOODLE through comparing of the online content design pattern, system configuration, interface patter and its effects on user's access rate.

3. Research Methodology

The study wanted to investigate the MOODLE interactivity from broad context using multiple sources of evidences, so a case study methodology applied as suggested by [32]. The Fig. 1 shows the stages involved in undertaking this study.
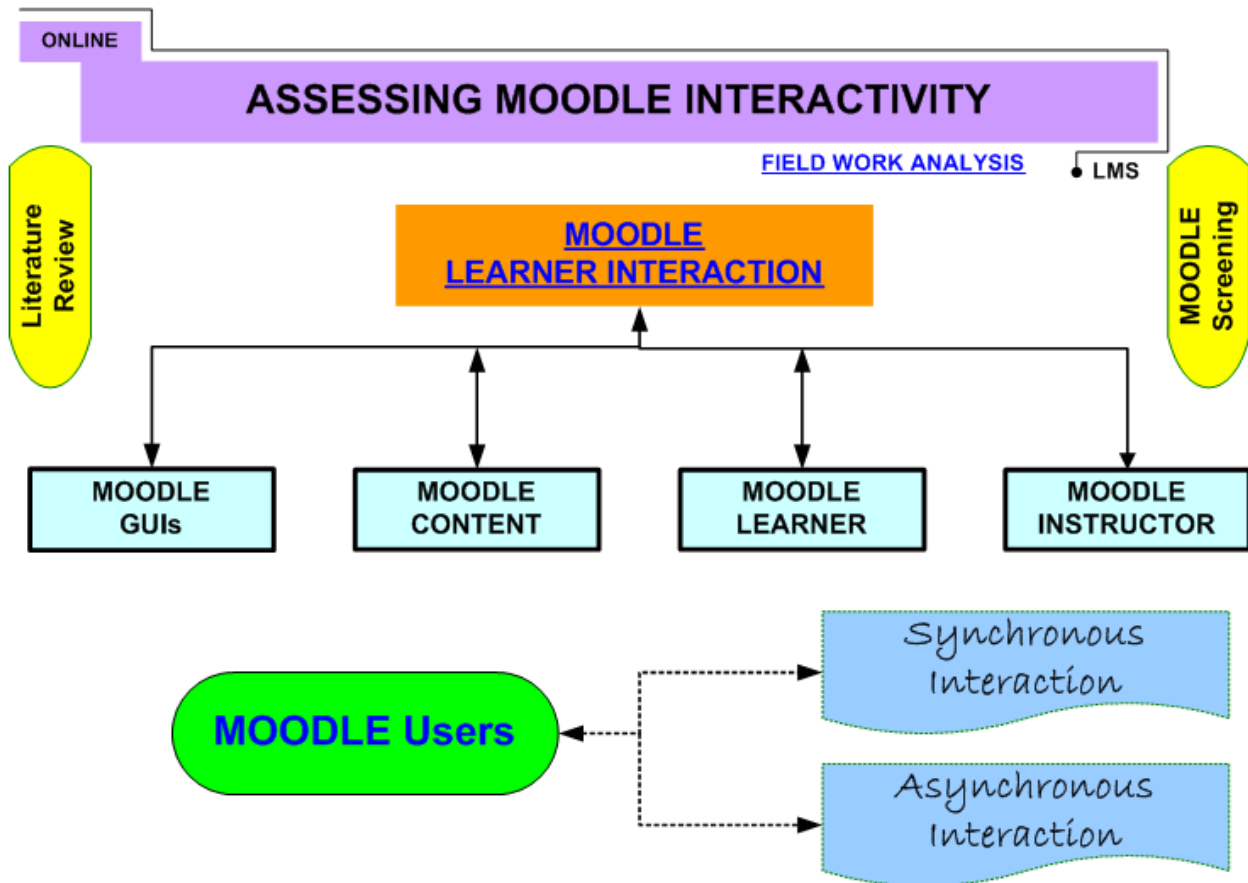
Figure 1: The Research Design

This study investigated learner's interaction with MOODLE platform, MOODLE content, other MOODLE learners and MOODLE instructors in either synchronous or asynchronous mode of communications.

In assessing the learner-interface interaction, the OUT-MOODLE was checked from its source codes and GUI features to assess the existence and fitness of the interactive features as per the standard HCI field. In assessing the learner-learner and learner-instructor interactions, a questionnaire was prepared and distributed among active students and instructors enrolled in MOODLE courses together with their statistical rates in using MOODLE interactive facilities. In assessing the learner-content interaction, the MOODLE courses were evaluated against pedagogical standards for design of online course. In this aspect, the integration of MOODLE with the standard contents packages was also investigated.

The research methodology employed included tabulation of frequency counts of student access to course contents, login rate to MOODLE and access rate calculations in interactive features. The statistical techniques and technologies were used to describe the data.

As shown in Fig. 1, the first stage of the study was to carry out extensive literature review, then the interviews with MOODLE learners (ML), MOODLE Instructors (MI) and MOODLE Administrators

(MAs) to bring out actual voices from the informants. Finally, the software source codes and configurations were screened for the purpose of establishing relationship between software designs against interactivity aspects.

To retrieve statistical data of usage of various learning objects (LOs) from MOODLE, the student logs-on reports were recorded. So, the data derived from MOODLE reports were used to gauge the level of interactivity.

3.1 Research Settings

The literature review, data gathering and screening of the MOODLE internal source codes and configurations were accomplished within two months (February and March 2016). The number of respondents and their average years of experience are depicted in table 1.

Table 1: Informants and Average Years of Experience

SN	MOODLE Users (MUs)	Informants	Average (Years)
1	MOODLE learners (MLs)	124	3
2	MOODLE Instructors (MIs)	32	5
3	MOODLE Administrators (MAs)	3	3
	Total	**159**	**3.3**

The informants were selected based on their experience in using MOODLE platform and the contents they have developed.

3.2 Data Collection Methods (Sample and Sampling Techniques)

To facilitate the interviewing of the selected respondents, four types of questionnaires were designed to interview *MOODLE Administrators (MA)*, *MOODLE Instructor (MI)* and *MOODLE Learners (ML)*. Questionnaires with multiple choice questions, open ended questions and face to face sessions formed the primary data for this research. In average, each interview session lasted for approximately 25 minutes but interview with MAs took longer than that because of technical questions and physical investigations of the software. The MAs are responsible for day to day management and administration of MOODLE and have access to source codes. The MIs and MLs are the final or ultimate MOODLE users.

In undertaking this study, a total of 159 informants reached with 3 MAs, 124 MLs and 32 MIs. The educational qualifications of the respondents range from professors (5), lecturers (8), assistant lecturers (13), and tutorial assistants (6) to non degree and undergraduate students (124).

Table 2 – Academic Profile for Informants

SN	Qualification	MI	ML	MA
1	Professors	5	-	-
2	PhD //Lecturers	8	-	-
3	MSc / Assistant Lecturers	13	-	1
4	BSc / Tutorial Assistants	6	-	2
5	Non Degree and Undergraduate Students	-	124	-
	Total	**32**	**124**	**3**

The selection of OUT as a field to undertake this research was due to its 9-years of MOODLE investment and presence of e-learning implementation strategy since 2008. In all research settings, data collection combined unstructured and semi-structured interviews, documentation analysis, participant and passive observation (MOODLE servers). For theory building study like this, the most important source of information is constituted by interviews [33].

The study applied specific computing research methods such as case study [34] for single MOODLE of observation and analysis, concept mapping [35] for MOODLE interactive features against standard factors of HCI, critical analysis of literature [36] for online learning and software interactivity, document analysis [37] including MOODLE installation guide and user manuals, organization's ICT policies and e-learning strategy, and MOODLE training reports, end user study [38] for students (MLs) and instructors (MIs), expert review [39] for MOODLE administrators and designers (MAs), exploratory data analysis [40] using statistical methods and techniques, focus group [41] during interviews, grounded theory [42] for HCI, pilot testing [43] for MOODLE customization, source codes and configuration testing, prototyping [44], simulation [44], systemic observation [45] during direct Observation from MOODLE server, and usability testing [46] for assessing multiple user logins (as MA, MI and ML) and feedback system.

4. Findings and Discussion

Generally this study revealed that there is a strict lack of interaction and interactivity among the MOODLE interface, contents and users with main reasons being inadequate software customization and configuration, poor content design, underutilization of interactive features and lack of multimedia features, expulsion of MOODLE external packages and user's behaviors.

At the moment, the version of MOODLE used at OUT is 2.8 with cumulative total number of users (learners and instructors) of 4051. This is just 3.89% of the total cumulative number of enrolled students and 11.2% of both active students and staff [53]. The software is administered by 8 MAs including one root user.

The frequency counts, access rates and MOODLE configurations were analyzed to discern patterns of interactions and interactivity in four categories: *learner-learner interaction*, *learner-instructor interaction*, *learner-content interaction* and *learner-interface interaction*.

4.1 Language Setting
While MOODLE supports over 70 languages, the OUT platform is configured to support English language only. This has been the case even for the Kiswahili and French courses where the teaching contents have been developed in Kiswahili and French languages respectively while the interfaces are left with default English language despite existence of the role renaming facility.

4.2 Status of Online Contents Development and Multimedia Integration
Use of multimedia files is of unique importance for enhancement of the online learning. This study revealed that the OUT-MOODLE has a total number of 628 courses registered and the content developed percentagewise is shown in the table 3.

Table 3 – Status of Online Courses Developed in OUT-MOODLE

SN	Percent Range	No of Courses	% of Total
1	0% - 9%	265	42.2%
2	10% - 19%	100	15.9%
3	20% - 29%	65	10.4%
4	30% - 49%	90	14.3%
5	50% - 79%	80	12.7%
6	80% - 100%	28	4.5%
Total/Average (%)		**628**	**100%**

520 courses equivalent to 82.8 % have been developed in less than 50%. The University has only 28 courses (equivalent to 4.5%) developed at in between 80% to 100%.

The study shows that the rate of merging courses with multimedia files is not satisfactory. Only 11courses (equivalent to 1.75%) have been implemented with multimedia integration. Out 628 registered courses, 8 courses (equivalent to 1.27%) have audio integration while only 3 courses (equivalent to 0.47%) have been developed with video recorded files. Throughout the study, it was observed that the multimedia software used at OUT-MOODLE include "Audacity- *software for recording audio directly from PC*", "NaturalReader-*software for courses which has no teacher to record directly in the computer, normally used to convert text to audio file (MP 3 format)*", "iSpring Presenter-*software for combining together audio file and power point presentation and then publish as video file in FLV format*", "Screen Omatic-*software for capturing screen and recording audio at the same time then provide video file in FLV format*" and "Articulate studio-*for creating online presentation-based training course*".

Table 4 – Courses Developed with Multimedia Files

SN	Multimedia Type	No. of Courses/628	Study Level						% of Total
			Foundation		Undergraduate		Postgraduate		
			No.	%	No.	%	No.	%	
1	Audio Files	51	3	5.88	48	94.12	0	0	8.12
2	Video Files	8	0	0	8	100	0	0	1.27
Total/Average (%) of the Total			**3**	**0.48**	**56**	**8.92**	**0**	**0**	**9.39**

Table 4 shows that the courses with multimedia based on the study level i.e. foundation courses, undergraduate and postgraduate courses. The study shows that no course has video integration in foundation and postgraduate level. However, for undergraduate level, the courses developed with audio make 94.12% of all courses which have multimedia integration while those developed with video files make 100%. This shows that the rate of multimedia integration is high in undergraduate courses compared to courses in foundation and postgraduate study levels. While in the postgraduate level there is no single course with audio file, the foundation level posses no single course with video file as well. Comparing the two multimedia types, it was discovered that audio integration is more adopted than the video integration.

Generally, the study shows that the rate of multimedia integration is very low for attainment of high level of interactivity since the overall development status reads only 8.12% for audio and 1.27% for video integration combining all three study levels. Additionally, the student access rate to the multimedia courses is not promising. While there is only 9.39% of all courses at OUT-MOODLE with multimedia integration (combining audio and video), the foundation level make 0.48%, undergraduate 8.92% and postgraduate 0%. On the other hand, the study shows that the multimedia integrated courses have more access rate compared to non-multimedia courses.

4.3 Design and Usage of Interactive Features vs. MOODLE Courses and Learner's Access Rate

Another important question item of investigation was the design and incorporation of the MOODLE interactive features in contents development and access rate by learners. The explored features were *forums, chat modules*, *messaging*, *assignments*, *quizzes, wikis,* and *web logs (blogs).*

The Table 5 displays the course contents development status based on the other MOODLE activity modules with focus on the number of courses and their associated user activities. It was discovered that there is a total number of 1,371 with various activity modules in OUT MOODLE.

Table 5 – Status of Activity Modules Developed in OUT-MOODLE

SN	Activity Module	No. of Courses	% of all OUT Courses	No. of Activities	% of all MOODLE Activities
1	Assignment	89	6.49	320	10.33
2	Assignment for Disabled Students	94	6.86	497	16.05
3	Book	24	1.75	31	1.00
4	Chat	29	2.12	47	1.52
5	Choice	7	0.51	20	0.65
6	Database	8	0.58	8	0.26
7	Folder	54	3.94	182	5.88
8	Forum	591	43.11	1253	40.46
9	Glossary	180	13.13	229	7.39
10	Quiz	75	5.47	161	5.20
11	SCORM Package	9	0.66	87	2.81
12	Survey	196	14.30	218	7.04
13	Wiki	19	1.39	44	1.42
	Total/Average (%)	**1,371**	**100%**	**3,097**	**100%**

The study shows that the leading MOODLE Interactive Feature (MIF) is forum facility appeared in 591 courses (equivalent to 43.11%) followed by survey 196 courses (equivalent to 14.30%). The MIF with lower number of courses is choice with only 7 courses (equivalent to 0.51%).

Regarding the learner's access rate, the study shows that most of the learners access the MOODLE forums with 1253 activities (equivalent to 40.46%), followed by assignment for disabled students with 497 activities (equivalent to 16.05%). The activity module with lowest access rate is database with only 8 activities (equivalent to 0.26%).

Another MIF is a chat module. A chat module is a simple synchronous communication tool allowing instructor to communicate with learners in real time. At OUT-MOODLE there are 29 courses developed with chat module with 47 various chat activities making up an access rate of 1.52%. There is no a one chat session for the entire course instead there are repeating sessions for multiple meetings. For the chat repeat sessions, the "*Don't publish any chat times*" is leading possibly because this has been configured as a site default chat setting and it is always open for access. Among the type of chat rooms, the ordinary is more preferred than the chat version without frames and Java scripts. However, the study has shown that the chats are not configured to be archived. The system also allows the use of a messaging tool for private communication between learner and instructor or between two learners. This MIF is a very useful

tool for learner-learner interaction.

Regarding the use of assignment types in MOODLE, the interest was to check which one is configured, the reason for selection and the access rate. From the design, MOODLE support four types of assignment types which are *Upload a Single File*, *Offline Activity*, *Online Text* and *Advanced Uploading of Files*. Based on the restrictions such as storage and allocation of disk quota set by MAs, '*the Upload a Single File*' assignment type has been selected. This allows each learner to upload a single file in any format, including a ZIP file. Learners are able to delete their uploaded files and are allowed to resubmit their assignments. There is a maximum size of 1 MB set by system administrator for a file upload but however this feature has never been used by instructors. Thus, learners are not restricted from uploading file of any size. The OUT-MOODLE has a total number of 89 courses developed with assignment activity module (equivalent to 6.49%) with learner's activities reached 320 making up access rate of 10.33%. however, the study shows that OUT has developed another type of assignment for disabled students for 94 courses (equivalent to 6.86%) with 497 various learner's activities with access rate of 16.05%.

Regarding the MOODLE assessment feature, in view of the fact that OUT is yet to conduct online assessment, the MOODLE settings on quizzes are left with default settings. All parameters such as number of quiz questions per page, allowed number of attempts and setting of time delay between attempts are left default. Another default setting is that of taking quiz in a secure window without forward and back buttons, address bar or other navigational features preventing learners from navigating to other sites during the quiz in which the requirement of entering password before taking the quiz to restrict who takes a quiz and when they take it. Although the quiz facility is not officially used for examination assessment at OUT, it was discovered that there are 75 (equivalent to 5.47%) courses developed with quiz facility with 161 various learner activities making up an access rate of 5.20%. Additionally, the interest of this study was to check whether MOODLE require network address to restrict access to the test to certain IP address ranges. This is one of the crucial requirements if MOODLE is to be used for online examination assessment of various question types including *multiple choice, True/false, Short answer, Numerical, Matching, Random short-answer matching, Essay* and *Embedded answers (Cloze).* The numerical questions in MOODLE require special text filters such as Algebra and TeX which have not been configured. Furthermore, there is no use of the useful formats for question importation. The facilities such as GIFT format, Missing Word, Blackboard, WebCT, Course Test Manager, Embedded answers (Cloze) and MOODLE XML are not integrated, hence impossible for importing questions. In the same way, the export formats GIFT, IMS QTI 2.0, MOODLE XML, and XHTML are also not integrated. The random questions are used and students are not able to upload digital content (essays, spreadsheets, presentations, web pages, photographs, or small audio or video clips) for grading through the assignment module.

Regarding the wiki facility, the study revealed that most of the courses have not been configured with this learning tool and hence learner cannot edit the page or add more pages to the wiki by creating links to new pages that do not yet exist. The OUT-MOODLE has only 19 courses (equivalent to 1.39%) with 44

various learning activities making up an access rate of 1.42%. Based on the wiki group permission (*no groups, separate groups and visible groups*), instructor can creates a single wiki that only the instructor can edit and learners can view the wiki but not make changes or can creates only one wiki for the class where all learners can edit the wiki. Also, there is a wiki for each learner where only the instructor and learner can edit. The HTML mode (*No HTML, safe HTML, or HTML only*) set in wiki is HTML only which enables the HTML editor. The binary files (graphics, audio, video, and other nontext resources are not allowed in Wiki. There is no any description of the used wiki autolinking options and the words in the wiki are not created by using *Camel Case* (*i.e., with a capital letter at the beginning and a capital letter somewhere else in the word*). The students are not given administrative privileges to edit in the wiki and the search, links, and administration tools are disabled for administering a wiki. Various ways of viewing wiki in MOODLE are: *Page index, Newest pages, Most visited pages, Most often changed pages, Updated pages, Orphaned pages, Wanted pages, Export pages* and *File download*.

The set permission (set page flags) for the wiki include TXT (text), BIN (binary 'graphics' content), OFF (offline), HTM (HTML content), RO (read-only), WR (writable flag). Equally, due to poor software customization, the few created wikis have a lot of orphaned pages (not linked). The orphaned pages cannot be reached through the ordinary wiki interface and so can neither track changes of the old versions in a database due to disabled strip pages nor revert mass changes to rollback changes to all pages if a particular author makes a mess of many pages in the wiki. Despite the few implemented wikis in MOODLE, the study revealed that the wiki's editorial policy for effective wiki practices does not exist at OUT. Since there is no wiki editorial policy, the central editor is not clearly defined. It is not clear if learners are completely responsible for their work. It is not clear on how the instructor deals with offensive content. In most circumstances, instructors tend to trust learners. But on the rare occasion, a learner may do something offensive; the case which will need to have a policy to deal with it. To rollback the changes by the author, instructor needs a clear policy statement.

Another studied MIF was a blog. A blog (web log) is another tool for interaction between learners. By default, all site users are able to view all blog entries, unless the system administrator have restricted blog visibility site-wide so that users can only see blog entries for people with whom they share a course or a group. It is reported that the OUT-MOODLE has 144 blogs created in various courses. However, this is a very small figure compared to the number of courses exist. Possibly, this can be due to the fact that blog in MOODLE is relatively a new feature and perhaps a weakness in blogging assignments comes from a lack of first-hand experience on the part of instructors.

As part of MIFs, database module was investigated. The database module provides a tool for collaborative development of a database within the course for creation of glossaries, catalogs, taxonomies, registrations, paper submissions, maps, or anything where learners can fill in a form to add data. A database is made up of fields that define data types (text, dates, files, URLs) and templates for controlling the visual layout of information when listing, viewing, or editing database entries. The OUT-MOODLE

has only 8 courses (equivalent to 0.58%) developed with database module and 8 various learning activities making up an access rate of 0.26%.

4.4 The Frequency Use of MOODLE Forums

One of the essential features of MOODLE for enhancement of learner-learner and learner-instructor interactions is use of forums. MOODLE offers five categories of forums which are: type 1 (*Single, simple discussion),* type 2 (*Each person posts one discussion),* type 3 (*Q and A forum),* type 4 (*Standard forum for general use)* and type 5 *(Standard forum displayed in a blog-like format).*

There are 591 courses (equivalent to 43.11%) developed with forums with main setting of forum type 4 (*Standard forum for general use).* The forum type 4 has been set to be a default forum. The system offers flexibility of changing the forum type but trend shows that the default setting is normally left untouched. The study shows that the OUT-MOODLE has 1253 learning activities related to forum module making up an access rate of 40.46%. So, it can be established that forum is the most utilized and leading MIF at OUT.

However, despite the fact that the forums are enabled, the roles are not defined. So the roles of instructor, learner and forum moderator are not well defined and therefore the interactivity between learners is hardly coordinated since there are no learner moderator groups. Additionally, the forum posts are not rated and are neither managed nor archived. It should be noted that MOODLE software has forum which comes with the forum capabilities such as *View discussions*, *View hidden timed posts*, *Start new discussions*, *Reply to posts*, *Add news*, *Reply to news*, *View ratings*, *View any ratings*, *Rate posts*, *Create attachments*, *Delete own posts* (within deadline ~ 30 minutes), *Delete any posts* (anytime), *Split discussions*, *Move discussions*, *Edit any post*, *Always see Q & A posts*, *View subscribers*, *Manage subscriptions*, *Initial subscription* and *Throttling applies*. The *Delete own posts* (within deadline ~ 30 minutes) forum capability is special for learners while the *Delete any posts* (anytime) is special for instructors. Despite existence of all these capabilities, the forums at OUT-MOODLE are not used to peer assessment in the course.

4.5 The Frequency Use of MOODLE Glossary Browse Types

Regarding the aspect of vocabulary of acronyms, the OUT has developed 180 courses (equivalent to 28.66%) of all courses and attained 13.13% of all defined module activities. Of all 3097 learning activities, 229 focused on glossary module with access rate of 7.39%. However, the OUT-MOODLE has no global glossary which links the whole site. Also, the existing glossaries are not organized into main and secondary glossaries and the system does not allow the duplicated entries of glossaries with more than one definition. While the comments on glossary definition are permissible, they are developed in the system. For easier glossary browsing, both options i.e. the **Show "Special"** link (selecting first character of a word from list and use of special characters such as @, #, $) and the **Show "ALL"** link (se to YES to allow learners see all of the glossary entries at once) are active. From the design, MOODLE allows four ways of glossary browse: type 1 (*Browse by alphabet)*, type 2 (*Browse by category)*, type 3 (*Browse by*

date) and type 4 (*Browse by Author*) with default setting being type 1. The system allows the glossary entries to be imported and exported using XML file and the learners to add glossaries but not to edit or delete other learner entries.

4.6 Assessing System Level Features: Learner-Learner Interaction and Interactivity

Other most vital interactions and interactivity settings in MOODLE are those from the system level. These include MOODLE configurations and customized features. One of these features that enhance the learner-learner interaction is the 'Forum auto-subscribe with email'. This feature allows learner to receive forum posts through emails without login in MOODLE. However, this feature is not configured at OUT-MOODLE. With forum tracking, the new added posts are highlighted and this permits learners to keep track of changes. Furthermore, even though the description box is working and learners can tell the MOODLE community a little about themselves, but only few learners have put their personal description.

4.7 Assessing System Level Features: Learner-Instructor Interaction and Interactivity

In assessing the system level features for the learner-instructor interaction and interactivity, the interest was to find out if the OUT-MOODLE is integrated with the LAMS and SCORM packages. The LAMS is an open source Learning Activity Management System with MOODLE that allow teachers to use a Flash-based authoring Environment. On the other hand, SCORM format (Sharable Content Object Reference Model) is a self-contained bundle of content and JavaScript activities which send data to MOODLE about the learners' scores and current locations. The study shows that the SCORM package has been patched into OUT-MOODLE with only 9 courses (equivalent to 1.43%) of all courses and 0.66% of all activity modules. Furthermore, there are 87 various learning activities associated with SCORM package making up access rate of 2.81%. The LAMS and IMS content package have not been integrated.

Other items looked for the learner-instructor interaction was the use of social format and type of student enrollment in a course. While the use of social format is not configured at all, the learner's enrollment in a course is configured but not automated. The system does not offer detailed participation reports of student activity to instructors, hence hinder level of interaction. The results show that the '***Ajax and JavaScript****' programming tools for dynamic web interfaces is also not working. The instructors are also provided with disabled features such as the '***Screen reader*', 'Time zone', 'Window options',*** and ***'Linking to a File or Website'***.

Another feature which can boost the instructor's interaction with learners is to allow the '***When editing text****' option to link to a file or website. This feature provides option to choose whether to use MOODLE's native HTML editor to enter text or to use plain text.

4.8 Assessing System Level Features: Learner-Content Interaction

Another vital aspect in assessing system level features is for learner-content interaction. Some of the features that allow the learner-content interaction and which have been configured at OUT-MOODLE are the setting of the ***Topics format*** *(default setting),* ***Weekly format and CSS/no tables****, **Course settings** –*

Category (labels), *Summary* in the course listings page, display course *Full name* on the top header of every page and in the course listings page and use of course *Short name and/or course code.* However, the *Course start date* and hiding of the upcoming sections in the courses to prevent learners from jumping ahead are not activated. Other features which are not active and therefore have impact on compromising the learner-content interaction are the *Show activity* reports, setoff maximum upload size by instructors, arrangement of meta and child courses, assigning a *Default* role, *interactive enrollment plug-in*, *Course enrollable* feature, setting of *Enrollment duration* and *Force groups* feature.

Additionally, the learner-content interaction can well be preserved by linking to OpenCourseWare (OCW) repositories such as MIT [47], USU [48], JHSPH [49], UK-OU [50], Wikipedia [51], and Wikibooks [52]. However, the courses in OUT-MOODLE are not linked with external open courseware. The software does not allow media content such as embedding .SWF files to be added. The results show that it is impossible to add multi-language content and create ZIP archive. Nevertheless, in all pages, the setting preferred (default) language is English.

4.9 Assessing System Level Features: Learner-Interface Interaction

Some of the features that allow the learner-interface interaction and which have been enabled in OUT-MOODLE are the '*Show the directory* links', '*Show the location* bar', '*Show the menu* bar', *Show the toolbar*', '*Show the status* bar', and the '*Default window width and height*'. Also the window can be scrolled and support of the RTF, PDF and HTML file formats.

However, the following fundamental features for learner-interface interaction are not configured. They include *'display of a directory', 'adding a label', 'compose a text page', 'restore link',* and *'tracking version'.* The study shows that the '*Window options'* to choose whether created text pages and web pages are displayed in the same or in a new window is not working. During undertaking this study, the system was investigating to assess if it supports various multimedia files types. The study shows that the OUT-MOODLE supports various picture formats such as PICT, TIFF, JPEG, GIF, and PNG, audio file formats WAV, MP3, RAM, and MOV and video file formats MOV, WMV, RV and RTF. The system also consists of special features for learners with visual disabilities including the OCR technology of OmniPage Pro although the feature was not activated.

The backup is taken regularly and the backup ZIP file can be restored, however, the backup lacks some details of the Meta course, users, logs, user files, course files and live logs (current activity) report which does not opens in a pop up window and does not refresh after every hour. The system also is limited in providing comprehensive site statistics.

Conclusion

As the rate of MOODLE adoption and number of online courses increases, the interaction of learners against learners, instructors, contents and interface will play a more central role in the teaching and learning process. The adopting organizations should apply best practices for designing effective online and blended learning environments. There must be considerations of software design aspects for

enhancing HCI, MOODLE interface settings, multimedia inclusion, pedagogical skills in content design, and patching and upgrading of software.

This study demonstrated a variety of features and settings necessary for making MOODLE to be interactive learning platform. By properly designing and well incorporating of MIFs, the MOODLE software may turn from being Computer Assisted Instruction (CAI) to Computer Managed Instruction (CMI) which can stand by itself as medium of instruction.

The study reveals that most of the MOODLE interactive features have not been utilized to the maximum and therefore lack of synchronous and asynchronous communication benefits among learners.

This is a result of poor software customization and an *ad hoc* adoption process from early stages of MOODLE selection, installation, usage and upgrading. There is a technical gap for MAs in both advanced software and pedagogical skills. The MAs do not keep track of further MOODLE developments and are unaware of new developed MOODLE interactive features. Disregarding of these HCI features and contents design are serious and may lead to failure for adopting HLI in attaining the real intended e-learning benefits.

Acknowledgement

References

[1] J. H. Lungo, and Kaasbøl, "*Experiences of open source software in institutions: Cases from Tanzania and Norway*", (2006)

[2] MOODLE Learning Platform, www.moodle.org, Date Accessed: 10-March-2016

[3] The Open Source Definition, www.opensource.com, Date Accessed: 12-November-2015

[4] How to use MOODLE 2.7: Teacher's Manual for the world's most popular LMS, Date Accessed: 05-March-2016

[5] MOODLE Docs: Guidelines for contributors – MOODLE
http://docs.moodle.org/en/MoodleDocs:Guidelines_for_contributors, Date Accessed: 06-February-2016

[6] The OUT MOODLE platform, http://elms.out.ac.tz, Date Accessed: 01-April-2016

[7] The OUT e-Learning Implementation Strategy, 2012; Date Accessed: 11-January-2016

[8] Y. Wang, X. Li, R. Gu, "*Web-Based Adaptive Collaborative Learning Environment Designing*", Springer-Verlag Berlin Heidelberg, (2004), LNCS 3143, 163168

[9] D. Engelbart, "*User Modeling and User-Adapted Interaction*", Volume 11, Issue 1-2, (2001), pp 65-86

[10] SINHA, Gaurav; SHAHI, Rahul; SHANKAR, Mani; "*Human Computer Interaction*", In: Emerging Trends in Engineering and Technology (ICETET), 3rd International Conference on IEEE, (2010), p. 1-4.

[11] T. Anderson, "*Getting the mix right again: An updated and theoretical rationale for interaction*", International Review of Research in Open and Distance Learning, (2003a), 4 (2). Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/149/230, Date Accessed: 12-April-2016

[12] Kuldeep Nagi, et.al "Evaluating Interactivity of eLearning Resources in A Learning Management System (LMS) - A Case Study of MOODLE", 2015

[13] Smith, P. L., and Dillon, C. L. "Comparing distance learning and classroom learning: Conceptual considerations". *American Journal of Distance Education,* (1999), *13*(2), 6-23.

[14] K. Soo, and C. J. Bonk, *"Interaction: What does it mean in online distance education?"* Paper presented at the ED-MEDIA/ED-TELECOM 98 World Conference on Educational Multimedia and Hypermedia & World Conference on Educational Telecommunications (10th), Freiburg, Germany. (1998, June 20-25) (ERIC Document Reproduction Service No, ED 428724)

[15] A. Kenny, "Online learning: Enhancing nurse education?" *Journal of Advanced Nursing,* (2002), *38*, 127-135.

[16] V. A. Thurmond, *"Examination of interaction variables as predictors of students' satisfaction and willingness to enroll in future Web-based courses while controlling for student characteristics"* Published Dissertation. University of Kansas, Parkland, FL: Dissertation.com. (2003). Available online http://www.dissertation.com/library/1121814a.htm

[17] E.D. Wagner, "In support of a functional definition of interaction", The American Journal of Distance Education, (1994), 8(2), 6-29.

[18] E. D. Wagner, "Interactivity: From agents to outcomes". In T. E. Cyrs (Ed.), *Teaching and learning at a distance: What it takes to effectively design, deliver, and evaluate programs*. San Francisco: Jossey-Bass Publishers. (1997)

[19] D. C. Hillman, D. J. Willis, and C. N. Gunawardena, "Learner-interface interaction in distance education: An extension of contemporary models and strategies for parishioners". *The American Journal of Distance Education, 8*(2), (1994), 30-42.

[20] M. Moore, "Three types of interaction". The American Journal of Distance Education, 3(2), (1989), 1-7.

[21] Ahmed "Interactions Quality in MOODLE as perceived by Learners and its Relation with some Variables", Turkish Online Journal of Distance Education-TOJDE July 2012 ISSN 1302-6488 Volume: 13 Number: 3 Article 25

[22] J. J. Gutierrez, "Instructor-student interaction", USDLA Journal, 14(3), 2000

[23] M. G. Moore, and G. Kearsley, *"Distance education: A systems view"*. Belmont: Wadsworth Publishing Company, (1996).

[24] A. R. Leasure, L. Davis, and S. L. Thievon, "Comparison of student outcomes and preferences in a traditional vs. World Wide Web-based baccalaureate nursing research course". *Journal of Nursing Education, 39*, (2000), 149-154.

[25] K. Swan, "Virtual interaction: Design factors affecting student satisfaction and perceived learning in asynchronous online courses". *Distance Education, 22*, (2001), 306-331.

[26] L. Atack, and J. Rankin, "A descriptive study of registered nurses' experiences with web-based learning". *Journal of Advanced Nursing, 40*, (2002), 457-465.

[27] M. Jiang, and E. Ting, *"A study of students' perceived learning in a Web-based online environment"*. Paper presented at the WebNet 99 World Conference on the WWW and Internet, Honolulu, Hawaii. (ERIC

Document Reproduction Service No. ED 448721), (1999)

[28] T. L. Faux, and C. Black-Hughes, "A comparison of using the Internet versus lectures to teach social work history". *Research on Social Work Practice, 10*, (2000), 454-466.

[29] C. R. Payne, "Good practice and motivation in online courses". *Virtual University Gazette*, (2002)

[30] R. L. Wilson, and M. Weiser, "Adoption of asynchronous learning tools by traditional full-time students: A pilot study", *Information Technology and Management, 2*, (2001), 363-375.

[31] G. Zafeiriou, J. M. Nunes, and N. Ford, "Using students' perceptions of participation in collaborative learning activities in the design of online learning environments". *Education for Information, 19*, (2001), 83-106.

[32] R. Yin, "Case Study Research". Sage Publication, California, (1989), pp: 22-26.

[33] L. Kantner, D.H. Sova and S. Rosenbaum, "Alternative methods for field usability research", In SIGDOC '03, Ft. Lauderdale, FL, (2003), 68–72.

[34] M. Alavi and P. Carlson, "A review of MIS research and disciplinary development", J. Mgmt. Inf. Sys., (1992), 3(4):45–62.

[35] J. P. Mead and G. Gay, "Concept mapping: an innovative approach to digital library design and evaluation". SIGOIS Bull., (1995), 16(2):10–14.

[36] M. Zelkowitz and D. Wallace, "Experimental validation in software engineering", Inf. Softw. Tech., (1997), 39(11):735–743.

[37] G. Marchionini and G. Crane, "Evaluating hypermedia and learning: methods and results from the Perseus Project", ACM Trans. Inf. Syst., (1994), 12(1):5–34.

[38] K. Rönkkö, M. Hellman, B. Kilander and Y. Dittrich, "Personas is not applicable: local remedies interpreted in a wider context", In PDC '04, Toronto, Ontario, (2004), 112–120.

[39] R. Molich and R. Jeffries, "Comparative expert reviews. In CHI '03 extended abstracts", Ft. Lauderdale, FL, (2003), 1060–1061.

[40] S. Kaski, (1997), "Data exploration using self-organizing maps", PhD thesis, Helsinki University of Technology.

[41] S. Sato and T. Salvador, "Methods & tools: Playacting and focus troupes: theater techniques for creating quick, intense, immersive, and engaging focus group sessions. Interactions", (1999), 6(5):35–41.

[42] R. L. Glass, V. Ramesh, and I. Vessey, "An analysis of research in computing disciplines", Commun. ACM, (2004), 47(6):89–94.

[43] M. Kyrillidou and S. Giersch, "Pilot testing the digiQUAL protocol: lessons learned", In JCDL '06, Chapel Hill, NC, (2006), 369–369.

[44] R.L. Van Horn, "Empirical studies of management information systems", SIGMIS Database, (1973), 5(2-3-4):172–182.

[45] J. J. Jensen and M.B. Skov, "A review of research methods in children's technology design", In IDC '05, Boulder, CO, (2005), 80–87.

[46] D. M. Hilbert and D.F. Redmiles, "Extracting usability information from user interface events", ACM Comput.Surv., (2000), 32(4):384–421.

[47] MIT, OpenCourseWare (OCW) repository, http://ocw.mit.edu, , Date Accessed: 13-March-2016

[48] USU, OpenCourseWare (OCW) repository, Utah State University http://ocw.usu.edu, Date Accessed: 14-March-2016

[49] JHSPH, OpenCourseWare (OCW) repository, Johns Hopkins Bloomberg School of Public Health http://ocw.jhsph.edu, Date Accessed: 18-March-2016

[50] UK-OU, OpenCourseWare (OCW) repository, UK Open University http://openlearn.open.ac.uk, Date Accessed: 20-March-2016

[51] Wikipedia, OpenCourseWare (OCW) repository, http://www.wikipedia.org, Date Accessed: 23-March-2016

[52] Wikibooks, OpenCourseWare (OCW) repository, http://en.wikibooks.org, Date Accessed: 23-March-2016

[53] The Open University of Tanzania (OUT), Facts and Figures, (June 2015)

Copyright Disclaimer