Comparative analysis between Moodle and self-made Learning Management System

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***Abstract*—Learning Management System (LMS), as a platform, provides a suitable space between learners and trainers for communication and interaction between each other. Moodle is one of the most widely used LMS and it is also used by our University. This paper presents an approach in which a survey on the Moodle system was conducted and on the basis of which a new system was designed. Hence, a comparative analysis was performed and is represented on this paper. Currently, the most popular open source LMSes are Moodle, ATutor, Eliademy, etc. The main purpose of this study is to compare between the most used open source LMS and our system. A survey on the interface design of Moodle system was conducted among the users of Moodle system. With the results obtained from the survey, we designed our own platform and compared the features with the Moodle system. Features like interaction, communication, security and user interface have been taken in mind. Findings from this research helped us in pointing out the limitations of Moodle LMS and allowed us to build a better system which is an improvement upon the shortcomings of the Moodle system.**

Keywords—LMS, Open Source, Moodle, Personalized Learning

I. INTRODUCTION

With the recent and rapid development of world wide web, information is relatively easier to access compared to the last decades. People are interested rather than forced to modern information sources. The education and courses for students of bachelors level and higher are not limited to the courses taught in university. However, the problem arises when classroom activities are not similar to results browsed on the internet. The solution is LMS which is a software application for the administration, documentation, tracking, reporting, and delivery of educational courses, training programs, or learning and development programs[1]. The learning must be personalized for the fulfillment of individual needs. The term personalized learning, or personalization, refers to a diverse variety of educational programs, learning experiences, instructional approaches, and academic support strategies that are intended to address the distinct learning needs, interests, aspirations, or cultural backgrounds of individual students[2]. A proper LMS must have the following features:

- Student ownership of their learning process;
- Focus on the learning process rather than "big end-of-year tests";
- Competency or mastery-based student progression;
- Anytime, anywhere learning[3]

While personalized learning is mostly based on students' ease in learning, LMS focuses on content management of courses and other accessories and discussion forum. The main features of LMS for personalized learning are:

- Manage learning content
- Manage user roles
- Deliver learning content
- Find learning goals
- Access learning content
- Check learning progress[4]

For instructors, there are separate LMS features:

- Course Management
- Sharing Resources
- Tracking Learner Progress[4]

Additional LMS Features include:

- Communication
- Collaboration
- Visual Reporting[5]

There are multiple personalized learning platforms based on LMS currently in operation targeting the higher education and corporate.

Moodle, a LMS based personalized learning website, has clean design and is fairly easy to navigate. Most of the universities have adopted it because it is an open source platform. It has a responsive design and drag and drop features for content management. It is available in 126 languages. Users can also export contents to portfolios and allows features for selling contents.

Blackboard, another LMS based personalized learning website, is useful for K-12, college and corporate. It is not free and cost varies by

organizational size. The system is moderately easy to learn and possesses adequate features. Hosting can be done on own servers and blackboard's servers. Integration of additional blackboard tools and a responsive design has made it fairly easy to use. Blackboard features the date submission for automatic availability of course. Syllabus consists of documents, pdfs and web links. Notifications include announcements, messages and emails by teachers. Contents are organized using 'items'. The system also comprises of audio and video discussion and learning forum.

Lastly, Canvas, another LMS based personalized learning website, is highly applicable for K-12 and higher education. It is free. However, an upgrade requires users to pay money. It requires 'publishing by teachers' to make the course contents available. It has interactive course calendar and course summary in addition to the courses. Contents are organized using 'pages' and 'modules'. Content management is highly structured in canvas. Canvas offers 'Big-Blue-Button' for real time sharing of audios, videos, chat, slides, etc for online engagement of any operation between teacher and students.

The comparative analysis depicts that Moodle has such great number of features that they seem messy with multiple plugins especially in tutor's dashboard. It requires personal hosting too. Certain tutorials may also be required to learn its highly customized administration side.

Based on the above features and case studies, the minimum viable model of personalized learning website on LMS must contain learning content management, delivery and access, learning goals, user roles management and learning progress with the focus on communication and collaboration at its core. The aim of this research is to point out the fields of improvements of the Moodle system from perspective of its primary users. The survey questions are prepared for collection of data and the they are based on Shneiderman's 8 golden rules and Norman's 7 principles.

II. Methods and Materials

The paper is based on the comparative study between the Moodle system that we have been using in our University and our self-made LMS system. The process of collecting data from the users was divided into two main phases: interview and survey and design and implementation. The interview was taken based on the paper prototype designed by the team. The paper prototype itself was based on the literature review and the outcome of the interview process were used to prepare questions for further survey. The results from the interviews suggested the following things be included in the design of the future UI/UX for the website:

- Discussion forum for teachers and students
- Direct content viewing and attachment
- More options and menus in the UI for easier navigation
- Necessity of mobile interface for mobile users

The completion of interview phase indicated that we proceed towards the survey phase. The survey was conducted online through Google forms. The questions were vastly related to how our system compared to Moodle system in terms of performance and ease of use.

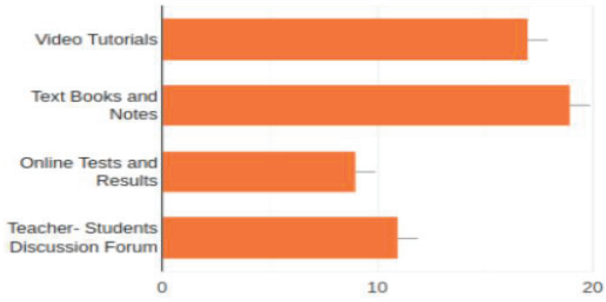

Fig. 1. Text Books and Notes were preferred by maximum number of students which was displayed by the votes they have given to each topic out of 20.

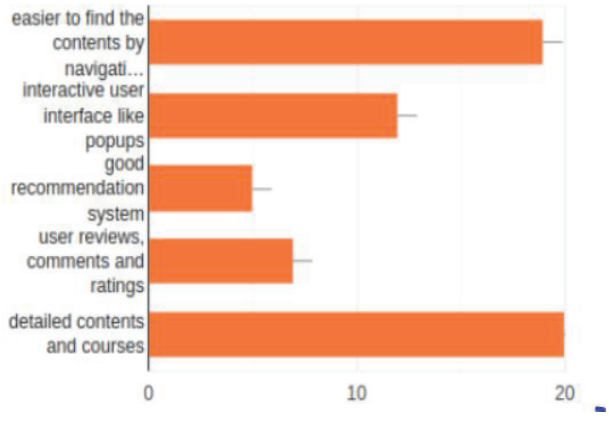

Fig. 2. 20 out of 20 votes were given to detailed contents and courses while 18 out of 20 votes were given to the easiness in finding the contents by navigation.

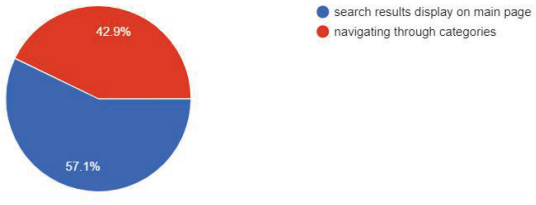

Fig. 3. 57.1% supported on having the search implementation on the main page over navigation to the categories.

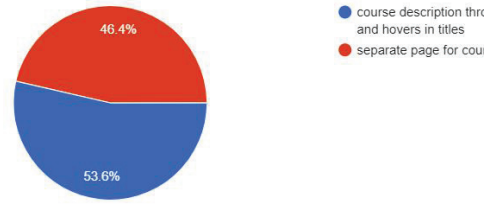

Fig. 4. 53.6% supported on having simple descriptions like about courses, course instructors can be given through hover dailogues over redirecting on the separate page.

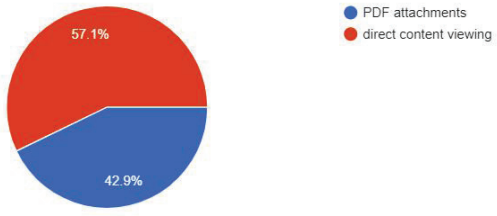

Fig. 5. When PDF links are clicked they are downloaded. 57.1% supported on having direct PDF content viewing without downloading over PDF downloading on clicks.

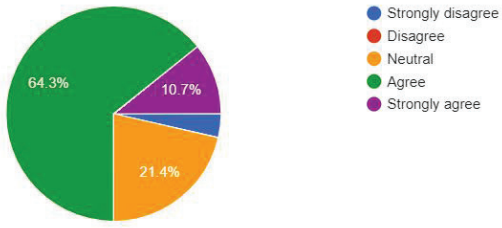

Fig. 6. 64.3% agreed that the design of the website shouldn't overpower the display and presentation of the content.

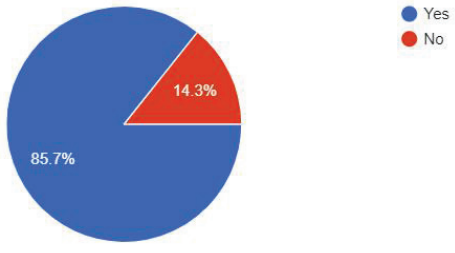

Fig. 7. 85.7% students supported that students should also be allowed to upload the contents while 14.3% did not support on students being allowed to upload the contents.

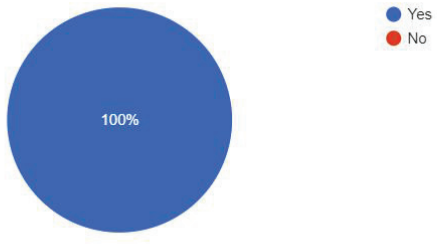

Fig. 8. Out of 68 students, 68 supported that they should be allowed to open discussion channel and begin discussion.

68 people who had prior experience in using Moodle system participated in the survey and their responses were recorded. Students that participated in the survey were from Kathmandu University school of Engineering, Science and Management. Based on the survey result, a minimum viable product (MVP) with a general interface, user authentication and LMS based dashboard was designed using the information received from survey. The MVP consisted of the following features:

- Discussion forum for teachers and students with the feature of messaging and video sharing
- Content attachment feature for slides, pdfs and video tutorials
- Easier navigation and search bar

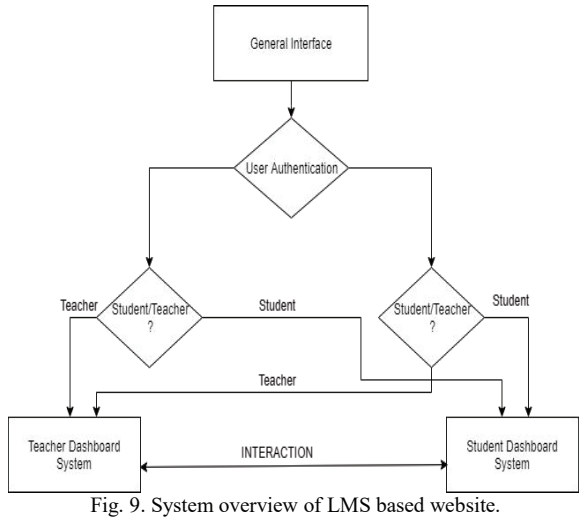

Fig. 9. System overview of LMS based website.

Fig-9 displays the system overview of a general LMS based website which was taken as a baseline for our self-made LMS system. The design and implementation phase were conducted after completion of the survey. A general user interface was prepared with home, login, about, courses, blogs tabs. The system allowed a general user to register either as a teacher or a student similar to a Moodle system. Logging in as a student provided users with different features described in Fig-10. The platform was developed using:

I. HTML

II. CSS

III. Bootstrap4

IV. JavaScript

Fig-10 shows that a student dashboard includes a main dashboard with courses that the student is currently enrolled in. The news and announcements made by the teachers can be viewed and events can be recorded in the calendar. There is an option to create events for personal use and delete it whenever required. Navigation bar consists of 'Courses' tab which provides options to view and click on individual courses that students are currently enrolled

in. Inside the individual courses page, name of the course instructor is displayed and the course description is displayed below it. The slides, pdf and video tutorials uploaded by the course instructor is available with easy navigation. The notices and announcements are posted alongside the slides.

Fig. 10. Student dashboard system

The feature of real time chat with the course instructor upon any confusions on the subject matter is also added on self-made system. The real time chat feature is a part of the discussion forum. Assignments and lab reports can be submitted through the course page and past questions can be viewed for practice. Similarly, the contents in the teacher's dashboard is similar in terms of content but vastly different in terms of features with the student's dashboard. The teachers can post course contents, slides, pdf and video tutorials by using the upload button on the page. The events can be changed and new events can be generated similar to the student's dashboard. Announcements can be made using the announcements button. Add button allows teachers to upload the past questions and 'Notices' and 'Past questions' are editable.

III. Results

The demonstration of UI/UX design of personalized learning based on LMS with results from surveys of 68 students familiar with online learning system of Kathmandu University was developed. Results of the survey are :

Table 1. Outcomes of survey on Personalized Learning Website[6]

Survey Questions	Majority	Percent
How often do you use Personalized Learning (elf/Moodle) website?	More than once a week	50
How much time on average do you spent in Personalized Learning website every time?	Less than 10 minutes	60.7
What do you believe are important contents of any Personalized Learning website?	Text books and notes	67.9
What do you prefer to have in Personalized Learning website?	Detailed contents and courses over good interface	71.4
Do you prefer search results display on main page or navigating through categories for searching contents?	Search results display on main page	57.1
Do you prefer course description through popups and hovers on same page or separate page for course description?	Course description through popups and hovers in titles	53.6
Should Personalized Learning website record your personal browsing data and cookies for better user experience?	Yes and No	50
Do you prefer pdf attachments like in elf or direct content viewing like in tutorialspoint?	Direct content viewing	57.1
The design of the website shouldn't overpower the display and presentation of the content itself, rather it should match the content.	Agree	64.3
As a teacher, what should your profile page contain?	Upload button for video tutorials, courses, etc	82.6
Should student be allowed to upload contents?	Yes	85.7
Should student be allowed to begin discussions?	Yes	100

The final outcome was a general interface and dashboards for student and teacher. The dashboard for student and teacher interact with each other and also provide functions like creating events for own purpose. The learning was made for self-paced and different management procedures were performed for the ease of use for both students and teachers. It was initially designed with minimum viable product however with field testing among 22 users, the additional features of communication and collaboration were also reached.

IV. Discussion

Development of additional features means users belief in the usefulness and effectiveness of platform if launched, since it has got some highly significant features than the Moodle system that is used by our University. The UI/UX design are well appreciated since old versions of university personalized learning websites were lacking eye-catching visual displays. Furthermore, with the introduction of single page smooth display of contents in dashboard, the usefulness seems far more effective than the Moodle system. Highly sophisticated discussion forum with user profile and the feature to add reactions on messages has been designed. The discussion forum is managed with video tutorials and IRC which provides a secure discussion forum. The provision of subject wise messaging and interaction of an individual with the instructor has been added. This is where the definition of personalized learning really comes into action. In the previous versions, questions had to be searched and the search displayed the results according to the matching strings. For e.g. a string search of CO might result in both COMP and COEG courses' past questions but in case of the present version, past questions are managed and provided by individual teachers.

The evaluation of an UI/UX can not be done in terms of only theory; there needs to be concrete evidence (data) to show how the improvements have been made. So, the final evaluation and comparison of the UI of Moodle system and self-made LMS was done by the students who used both systems (Moodle system and self-made LMS system).

A group of 22 students participated in the evaluation and the cognitive walkthrough of the students from Kathmandu University were recorded. The following is the ethnographic proceedings of the 3 students (students currently using the Moodle system) who had problems of their own while using Moodle system. The following demonstrates how the problems they faced in the Moodle system has been properly addressed in the self-made LMS system.

- Student from KUSOM (Kathmandu University School of Management) who wants materials uploaded by teachers such as lecture slides, videos and additional resources kept in a manageable way on different tabs. (Name: Anupam Parajuli)
- Student from KUSOE (Kathmandu University School of Engineering) who wants all the activities and announcements related to a course updated on the website. The announcements may be things like presentation time, course completion notice etc. (Name: Diwash Ranabhat)
- KU student from mechanical department who requires the availability of past questions on the platform. (Name: Rasbin Sharma)

We assumed that all three of the students started their experience from the homepage. Then, their transition from one state to the other on the platform was recorded in the following manner:

Firstly, Anupam looked at the homepage, and his eyes hovered through the navigation bar. He saw a link to the dashboard on the navigation bar and clicked on that link that directed him to the dashboard. He naturally saw the toggle menu on the left side of the page and clicked on that toggle menu which displayed the courses currently being studied by him (these were dummy courses added for evaluation purpose only). Then he clicked on the topic of his interest. A new page displayed the contents of the subject and what topics were currently being taught by the instructor. The website had different tabs for lecture slides, video tutorials and additional resources which solved the problem of Anupam and students like Anupam who said that they had these problems while using Moodle system.

Diwash, who frequently uses Moodle system and had problems with its UI also started from the homepage of the self-made LMS. In the same manner as before, he landed on the dashboard from the homepage. From the dashboard page, he clicked on the toggle menu. He saw the Notices title and then navigated to that link. The current announcements and updates regarding subject matter were posted on this page. He could also search for a particular notice from the search bar. This solved his problem that he faced in using the Moodle system.

Rasbin also navigated to the dashboard and through the toggle menu, he saw the past questions menu. He clicked on that link and the page that opened, provided all the past questions and resources required by Rasbin for a particular subject. The past questions for the each of the subject currently being studied by Rasbin were separated into different tabs for convenience.

The evaluation done by the users (students) themselves show how our self-made LMS system is an improvement upon the Moodle system by the addition of new and improved features that were previously not provided in the Moodle system.

However, the system can be further improved with number of additional features. The collection of data for user's ease of using website in personalized way can be an additional feature. The data, usage of data and options for collecting data must be taken into

consideration since these factors determine the effectiveness of a personalized LMS. Additional considerations for competition in market includes hosting the LMS, security, protecting student data and mobile device access. For LMS websites to be more effective, it must be integrated with other systems via SCORM or TinCan API. Using either of these after completion of certain course, the data from LMS can be sent to database and certificates can be generated even though test is taken outside the LMS itself. Using either of two, different plugins can be generated like Dropbox application. The online library and online grading system is highly used in current LMSes. Online library is where course instructors add extra books so that the books will be available for students for entire course duration. Online grading is one of the prime essentials in today's LMSes. Through online grading, teachers can grade quizzes, assignments and lab reports online with comments for improvements in particular quiz, assignment or lab report. An application software can never reach its completion. There is always a room for improvement. Likewise, comparison of the Moodle with our platform displays some of its limitation compared to our platform. The fulfillment of these limitations can help us build a better system that improves upon the shortcomings of the Moodle system.

V. Conclusion

A LMS based personalized learning website was developed for creating user friendly environment for both students and teachers with the study of related works on Moodle, Canvas and Blackboard which are LMS based personalized learning websites. The results generated from survey, field interview and field testing among related users enhanced the design and development. The properly managed dashboard based on LMS is one of the main and additional feature. The application of SCORM or TinCan API allows the system to be integrated with other systems which provides functions like visual reporting and certification. The model developed by us performs as an initial idea for LMS platforms of the future with its brilliant minimum viable product and all the basic features with two additional features, communication and collaboration features included.

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