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Learning Management System Implementation. Case Study on User Interface Configurations.

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***Abstract*:** *Using ICT, it is possible to build an educational process that will not only be independent of time and space, but also provide quick access to educational materials. In this case, educational material can be not only in a readable format, but also in the form of video materials. In the Kyrgyz Republic, the use of distance learning can be helpful to solve a number of problems. The focus of this study is the usability problems faced in Learning Management System, as well as to investigate factors influencing usage of the system. In the frame of the study, we have used several methods, including survey, the RAM usage analysis and loading time compression tests. Results suggested that the LMS usage could be widely adopted in the region. In addition, within the analysis of usage problems, decrease the loading time in Moodle by organizing the course resources, and hence improving the loading time and stopping users from abandoning the site was done.*

Keywords: *Distance education, learning management system, user interface, user satisfaction*

1. INTRODUCTION

We live in a world where technological innovations occur very quickly and digital technologies are becoming an integral part of everyday life. Technology not only provides an opportunity for rapid communication, but also for building systems that facilitate many aspects of our lives. These advantages of information and communication technologies (ICT) are used in entertainment, business and government. The use of ICT to improve the activities public sector organizations is called e-government. E-learning can be considered as one of the dimensions of e-government. With the help of ICT, education not only provides time and space independent education, but also provides quick access to learning materials [4]. For this reason, it is necessary to analyze the perceptions of both students and instructors in order to make a Learning Management System (LMS) a valuable part of the education system.
In the Kyrgyz Republic, the use of distance learning can be helpful to solve a number of problems. Many studies considering e-education in the country have shown that the use of LMS has a great potential not only for higher education but also for secondary education [13]. However, there is another problem with the use of LMS for education. For example, the rate of computer literacy among users is low [3]. Nevertheless, it has been emphasized that the use of internet technologies as a training tool is supported by young people in the country [9].

2. LITERATURE REVIEWS

Distance Learning by definition is the method of teaching and learning with other means than traditional teaching method of being physically present in the environment of teaching and learning. The methods to transfer information for distance learning may include but not limited to television, radio, magazines, mail, compacts discs, video tapes or internet.

2.1. Early Form of Distance Learning

The concept of LMS can be considered relatively new compared to the concept of Distance Education (DE) which's root dates back to late 1800's. Sir Isaac Pitman's Correspondence Collages was founded in 1840 England and his correspondence course study was one of the first forms DE [6]. The study materials were being sent by free mail delivery service. Within a few decades the method of correspondence was adopted by several other countries including Germany, Canada, Australia, the Soviet Union, Japan and the United States [6].

Vast number of studies has been done on Learning Management Systems, but majority of the studies focus on comparison of the system and importance of implementing the systems. Yet the number of studies done on usability is insufficient.

2.2. Learning Management Systems

The term "Learning Management System" refers to software applications for the documentation, archiving, administering and tracking the source study materials, reports and assignments [15]. It helps organizations and intuitions to create learning programs, track assignments, administer and evaluate tests and archive learning materials for later use in a virtual environment. Being open source, Moodle can be given as a popular example of such Learning Management Systems.

2.3. What is Moodle

Moodle, an acronym for Modular Object-Oriented Dynamic Learning Environment is a popular open source LMS designed for educators to create dynamic online courses [7]. With its multifunctional and interactive features Moodle is can be considered a superior alternative to traditional learning methods. A significant advantage of Moodle over its leading competitors is their foundation in social constructivist pedagogy embedded in its features to support student learning [8].

The high cost of distance learning is widely known, and as the institutions become more large-scale providers of distance learning the cost-effectiveness becomes more crucial [2]. The increasing cost of proprietary Learning Management Systems was a concern for most institutes (as cited in [14]). A system called 'MobiGlam' used by Koole et al. [5] to examine usability, learning and social interaction of students' mobile access to Moodle courses. From this example, one can see how mobile learning greatly enhances the possibilities of using Moodle as a part of an overall distance learning method.

2.4. Wideness of Moodle usage

Moodle is widely used among Learning Management Systems, with 106,176 registered websites in 228 Countries [7].

Moodle is used by a variety of institutions and individuals, including:

- Universities
- High schools
- Primary schools
- Government departments
- Healthcare organizations
- Military organizations
- Airlines
- Oil companies
- Homeschoolers
- Independent educators
- Special educators

However, considering Moodle usage in the Kyrgyz Republic, the LMS is used by higher educational institutions only. Thus, according to Nurakun Kyzy et al., Moodle is used mostly together with self-developed systems [12]. One of the main concerns in use of this LMS is the user interface of the system.

2.5. Problems faced by with Learning Management Systems

Learning Management Systems offers various tools and services for the end user such as documentation and tracking of the activities as stated before. However, to use these may cause new issues and challenges for the end user. As stated by Ssemugabi [18], majority of these challenges are associated with Learning Management Systems arise from technical limitations of computers and the internet, and not being able to get adjusted to the system because of low rate of ICT literacy.

As many researchers noted, these challenges can be categorized as [1, 16, 17];

- ICT illiteracy and feeling of discomfort while using ICT solutions
- Poor maintenance and Inefficient User Support Strategies
- Poor institution-wide regulations
- Selection of LMS and usability problems

Even though the learning management systems are widely used in higher education and corporate organizations, the number of researches done to examine the usability of such systems is insufficient. In applications, whose target audience is not necessarily consisting of high ITC literate individuals, usability is an essential party. According to the interview and further feedback from students, most of the LMS application designs are filled with redundant symbols and icons making the interface messy and hard to navigate. The overload of the information in webpages makes it difficult for low ICT literate individuals to focus their attention and navigate through the web page. These usability issues raised couple of questions:

- Is Moodle too complicated for novice users?
- Is there a usability problem with Moodle?
- Is the user satisfied while using the system?

3. METHODOLOGY

The main focus of this study is the usability problems faced in Learning Management System, as well as to investigate factors influencing usage of the system. Therefore, in the study, several methods have been used.
First, the 3.3.4+ version of Moodle was built. On the system, as a case study, 2 courses were launched. For the case study, we kept the default Moodle interface. Since the aim was to use the Moodle system as an additional component of selected courses, the lessons were conducted in a traditional way, with support in Moodle. For that, video content was prepared and uploaded to the system after each lesson. Additionally, reading materials, presentations and quizzed were placed.
To test the usability problems faced in LMS, we have stared with the user survey. The survey was conducted among students enrolled in courses, selected for the case study.
Next, the RAM usage analysis and loading time compression tests were conducted.

4. RESULTS AND GENERAL OVERVIEW

4.1. Student survey

A pilot study, carried out at the computer-engineering department of Kyrgyz-Turkish Manas University can be considered as an example of LMS implementation in the country. In the scope of this study, hybrid type of education was applied to one of the undergraduate courses provided by the department. The grade point average of the students showed an increase of 20%. However, since in the case study, only one course have been involved, yet further research is needed to identify all factors affecting the success of such courses.

Concerning details of the case study, as an LMS in this course, we have used Moodle. At the end of the course, a survey about the opinions of students about the system was conducted. According

to the survey results, 45% of the students said that the Moodle system was easy to use and 59% said that they would use the system in the future (Fig. 1).

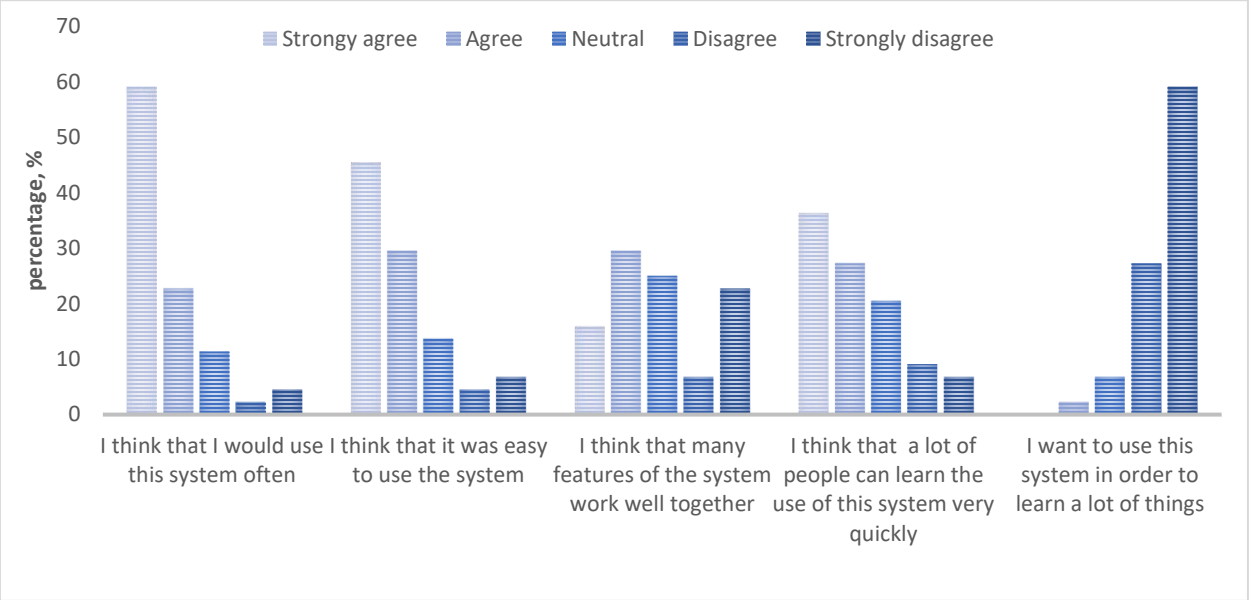

Figure 1. *Students' perception of Moodle system (positively defined questions).*

The second set of questions were negatively defined ones. According to the results, obtained in this section, 16% of users said that the technical support system could facilitate the use of the system (Fig. 2).

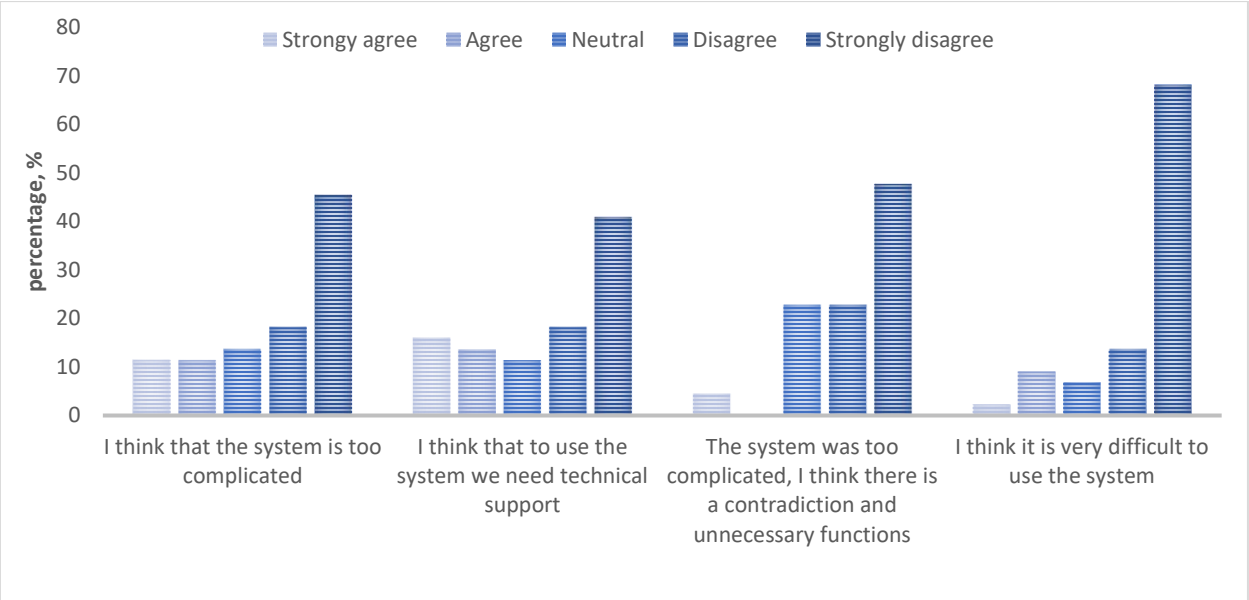

Figure 2. *Students' perception of Moodle system (negatively defined questions)*

As a direct derivation of the Fig. 3 we can assume that e-learning has a great potential in the Kyrgyz Republic as 68% of students states that it would be helpful if we had video lessons available for other disciplines; 75% indicated that they thought the video lessons were useful (Fig. 4).

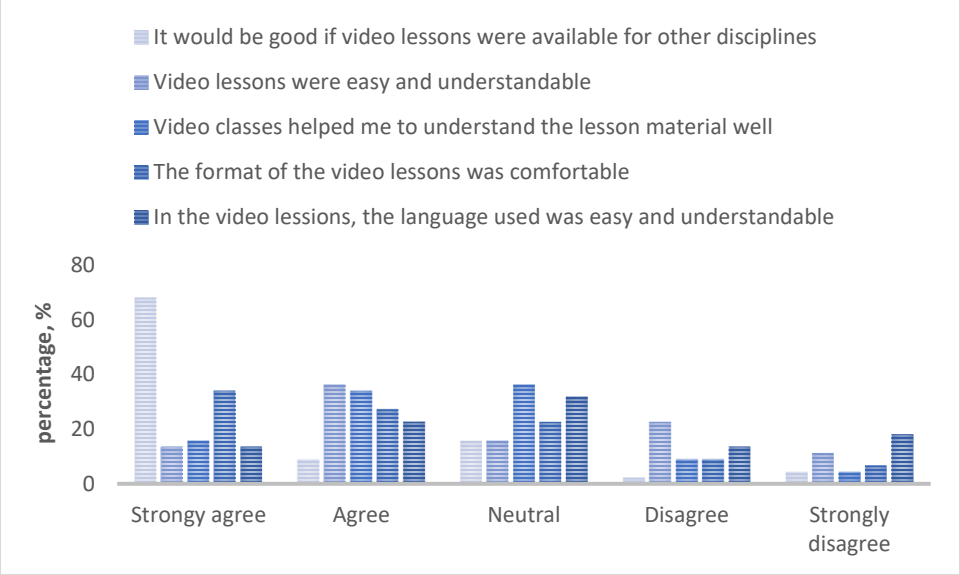

Figure 3. *Students' perception of video content (positively defined questions).*

For this set of question, we also added the negatively defined ones. Results of this section go in line with the positively defined ones.

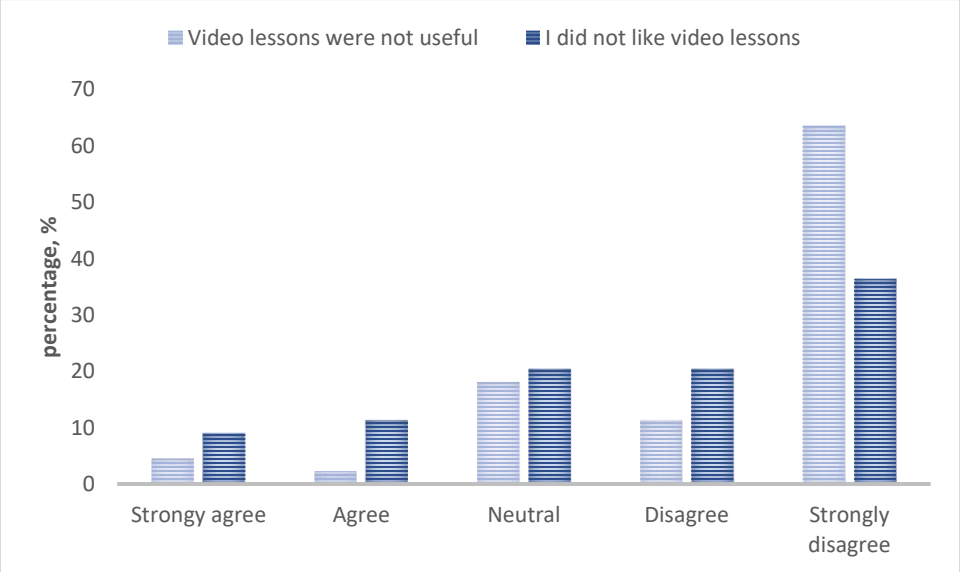

Figure 4. *Students' perception of video content (negatively defined questions).*

4.2. The Simplification of User Interface

To face these issues the simplification of the user interface seemed necessary. To simplify the user interface the layout of the page should be optimized to increase information hierarchy and decrease the cluttering. An example of the layout optimization can be seen in the figures below. Fig. 5 shows a bad example of layout design. In the design, used in Fig. 5, it is hard to navigate and hierarchy is not obvious while on the other hand in the Fig. 6 the information hierarchy is established and it is easier on the eye of the user. Simplification of the user interface makes it easier for novice users to adapt the system.

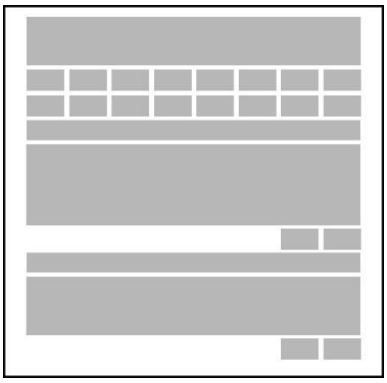

Figure 5. *An example of bad layout design*

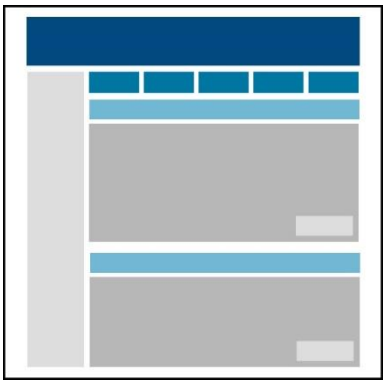

Figure 6. *An example of good layout design*

4.2.1. Decluttering and optimizing the pages

By default, Moodle system has 38 unique blocks for users to use for their needs, which 31 of them can be used on course pages. A fresh course page without any customization will only have ‘Navigation’ and ‘Settings’ blocks. Even though adding block near essential and provides lots of customization and functionality, these blocks may hinder the performance of the system hence the user experience will suffer. Each block will take up additional RAM while the page is generated.

To maximize the performance of the page one needs to keep the amount block to minimum. The ‘Comments’ and ‘RSS’ block showed to be most RAM consuming blocks with taking up 7.4MB RAM and 6.2MB RAM respectively. In the figure (Fig. 7) below one can see the amount of time to generate a page increases with each added block.

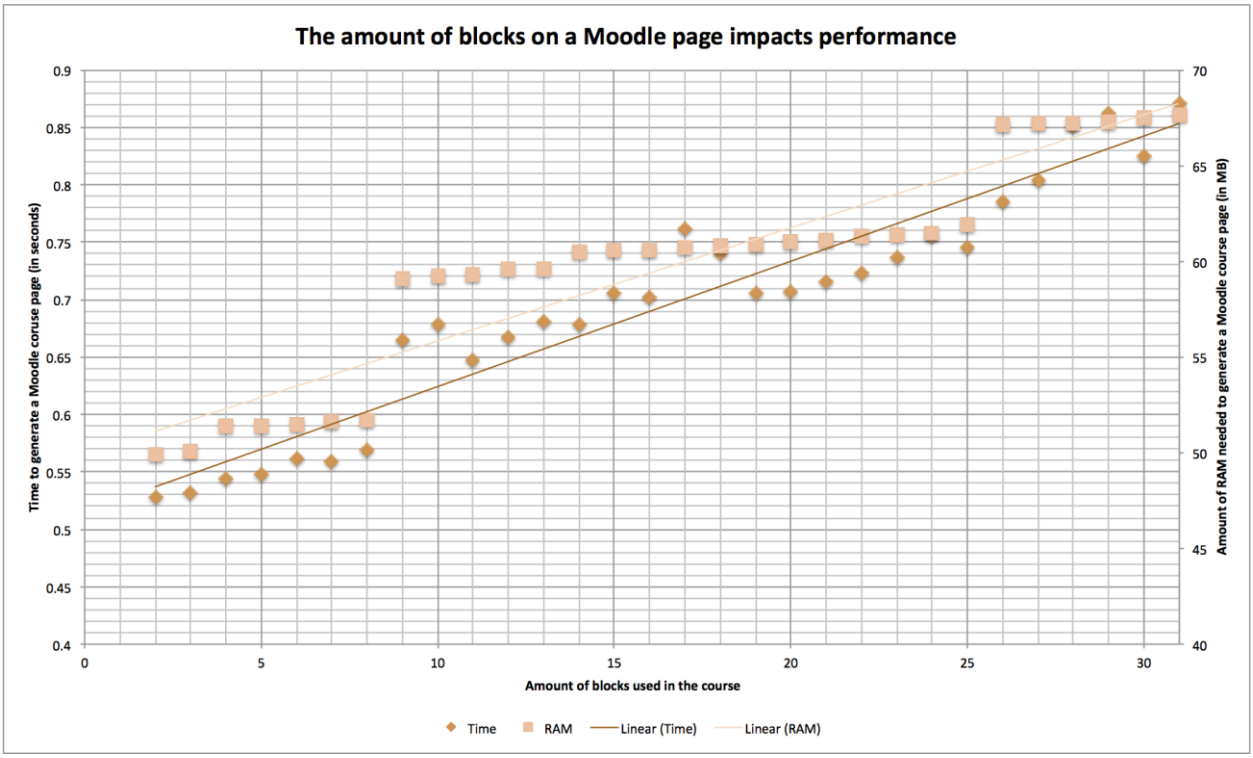

Figure 7. *Graph showing time needed to generate a page with added blocks. (from www.iteachwithmoodle.com).*

Using images during a course design makes the course easier to understand, navigate and much more appealing. But using too much image may also hinder the performance of the system. In the Fig. 8 and Fig. 9 below one can see the amount of database write and read calls made with each added amount of image.

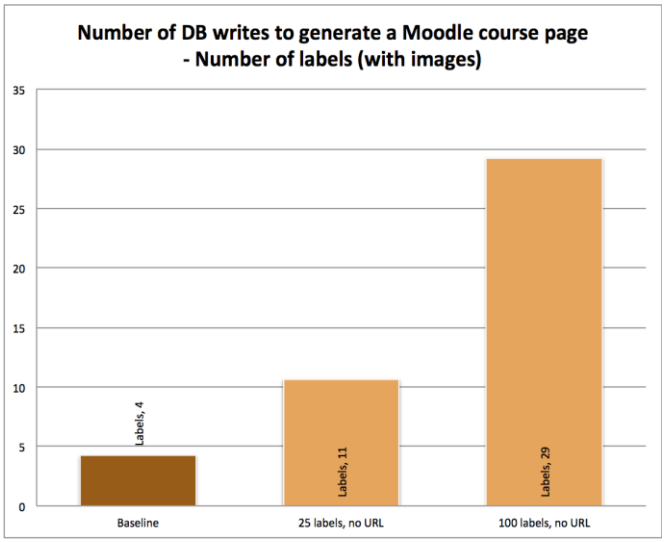

Figure 8. *Number of DB writes to Generate a Moodle Course Page - Number of Labels (from www.iteachwithmoodle.com)*

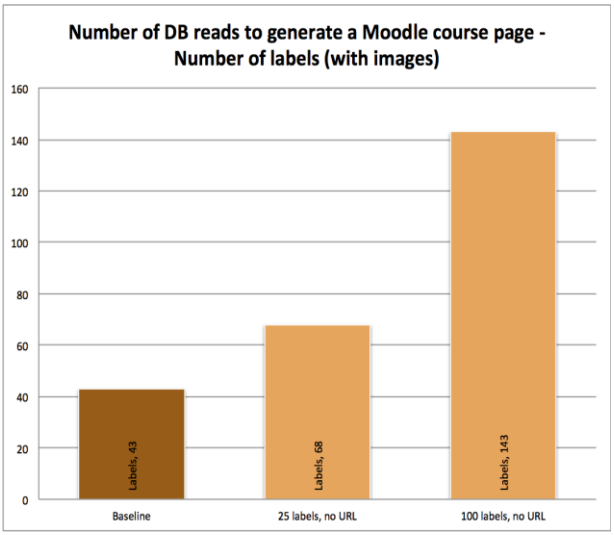

Figure 9. *Number of DB Reads to Generate a Moodle Course Page - Number of Labels. (from www.iteachwithmoodle.com)*

Considering the number of data base calls needed to generate a page with multiple images, inserting the images via URL instead of uploading directly to the Moodle system will decrease the number of needed calls hence improve the performance of the page.

4.2.2. Responsiveness

Responsive Web Design is an approach to web design in which a site is built to deliver an ideal viewing experience, easy reading and navigation with a minimum of resizing, panning, and scrolling across a wide range of devices like desktop, notebook, tablet, smart phones and other gadgets [11]. Since 61.5% of students stated they have smartphones and used it to access the pilot course, the responsiveness of the LMS is crucial.

Moodle is readily published as responsive web application but it can be further optimized to meet the necessary requirements to satisfy our needs to make it easier for novice users, such as decluttering the pages and increasing the visual hierarchy with use of colors and text points.

4.2.3. Heat Map

User interaction data is crucial for improving the user experience in web developing. To get a better understanding of user behavior one can use the help of heat maps. Compared to a traditional analytic a heat map focus on user behavior within the page not between the pages. A heat map tracks a user's cursor on the screen and presents the data as colors so it is easier for human understanding. It is a quick way to visualize data with the help of a heat map it is easier to see which parts of the page getting the most attention of the user so one can optimize the layout accordingly. An example for heat map of a webpage, taken from clicktale, is shown below in Fig. 10.

Figure 10. *A heat map example (from www.clicktale.com)*

An easy way to make use of heat maps in Moodle is by using the plugin called 'Heatmap' which is free to use. The plugin gives the user ability to add 'Heatmap' blocks to course pages separately and track the number of visitors to each activity of the course. The plugin keeps track of the data

and visualizes it in real-time and can be toggled on and off. The effect of the plugin is invisible to the 'student' users.

With the help of this plugin a teacher can improve the interaction in their courses by highlighting the less or more interacted activities.

4.2.4. Difference Between CSS & SCSS

The term CSS stands for Cascading Style Sheets and it describes how html elements are to be displayed on certain medium such as screen, paper, or in other media [19]. Moodle uses SCSS instead of CSS since SCSS shortens the code. In SCSS we can define variables as we can in php, which allows us to use the predefined variables over and over again. An example can be seen below;

```
body{
 width: 850px;
 color: #ffffff;
}
body content{
 width:648px;
 background:#cccccc;
}
```

Code snippet 1. *CSS example*

```
$color: #cccccc;
$width: 850px;

@mixin body{
 width: $width;
 color: $color;

 content{
  width: $width;
  background:$color;
 }
}
```

Code snippet 2. *SCSS variable example*

As it is seen in the example above the color and width has been defined and used as variables. This feature of SCSS allows for easier and more complex coding for the programmers. Another useful feature of SASS syntax is that it allows for nesting which makes the code easier to read;

```
nav {
 ul {
  margin: 5px;
  padding: 10px;
  list-style: none;
 }

 li { display: inline-block; }

 a {
  display: block;
  padding: 6px 12px;
  text-decoration: none;
 }
}
```

Code snippet 3. *SCSS Nesting feature*

CSS and SCSS can be further used to distinguish blocks of the webpage to make it easier to navigate and enhance the hierarchy.

5. CONCLUSION

A systems performance, visual appealing and user experience is crucial for its success especially when it comes to Learning Management Systems. As it has been stated before in this study using Learning Management Systems can be challenging for novice user due to high ITC-illiteracy rate. To make the adaptation processes to the system relatively easier for user one needs to take user experience in consideration. In this case to enhance the user experience of Moodle LMS, simplification of the user interface and decluttering has been done. The optimizations are made with consideration of the system performance.

5.1. Page Generating Time

As the page generating time increases the user experience is impacted negatively. According to a study done by Nah, a user's tolerable waiting time for information retrieval is approximately 2 [10]. As one can see in this study, it is possible to decrease the loading time in Moodle by organizing the course resources, using external images when possible, minimizing the number of blocks per page. By doing optimizations mentioned above, there will be less database calls, caching and RAM usage will be decreased hence improving the loading time and stopping users from abandoning the site.

5.2. Improvements on User Interface

With the necessary optimization now, the side panel on the right is always collapsible and completely removed while viewing courses to increase usable space for the content. In the Fig. 12 below you can see the representation of the course page layout from default boost theme of Moodle Learning Management System and in the Fig. 11 shows the representation of the optimized course page layout.

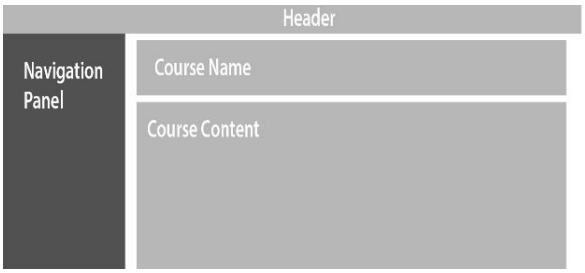

Figure 11. *Optimized layout*

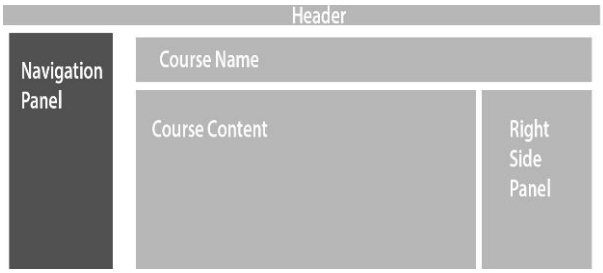

Figure 12. *Original boost layout*

After the optimization, the information clutter and distraction caused by the right-side panel is solved and in return, the available space for the course content has risen by 22.29%.

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