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C O N T E N T

ANALYSIS OF MOODLE ACTIVITIES BEFORE AND AFTER THE COVID-19 PANDEMIC – CASE STUDY AT GOCE DELCHEV UNIVERSITY

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Abstract The primary goal of this research is to analyze the number of activities of Moodle users before and after the pandemic. This is a case study at Goce Delchev University in Shtip. We have been using Moodle e-learning system for about 10 years. In 2020, the study process at our university was moved to distance learning due to the newly created situation caused by the Covid-19 pandemic. This is the reason why we wanted to find the difference in terms of the number of activities in 2019 and 2020. For this purpose, we analyzed the data from our Moodle database using Big Data tools. According to our results, the total number of activities in 2020 was increased by 3 times compared to the same period in 2019.

Keywords. Moodle, Covid-19, Hortonworks, Big Data, Big Data Analysis

1. Introduction

Covid-19 disease spread throughout the world within a few months and was declared a pandemic by the World Health Organization on 11th March 2020. This pandemic has successfully forced global shutdown of several activities, including educational activities, and this has resulted in tremendous crisis-response migration of universities with online learning serving as the educational platform. All countries in the world have faced a situation in which there was no possibility for normal functioning of formal education, and it was necessary to ensure continuity in education for all students. Universities around the world had to close their campuses down in the spring of 2020 and shift all their academic programs online. The crisis caused by the spread of the Covid-19 highlighted the needs and challenges in such conditions to ensure the right to education. Not all universities were well prepared for such a transition from classroom-based education to completely online education. There have been many advances in educational technology in the last few decades and they proved to be immensely useful during this pandemic. Several online platforms, which support online education, were available. Nevertheless, it was a challenge for universities to map their educational activities in an online space. Additionally, professors and students faced a wide range of logistic, technical, financial, and social problems [1].

On the other hand, this crisis, in addition to the insecurity and fear it caused, encouraged the search for new solutions for the organization and implementation of teaching and learning. It is also an opportunity to better understand various aspects of teaching and learning, and to identify new tools and contexts to support the learning of all children and young people.

Even before Covid-19, there had already been high growth and adoption in education technology, whether it was language apps, virtual tutoring, video conferencing tools, or online learning software, but there has been a significant surge in their usage since Covid-19. While distance learning in general is considered as an option, an alternative to traditional learning, during the Coronavirus pandemic it became an essential element in sustaining school and university activity [2].

Huge numbers of students were suddenly transferred to online classes to ease campus closures. In general, the capacity of the tertiary education system is much higher, as is access to technology and skills, as well as student autonomy [3]. With the onset of the pandemic, the whole world turned abruptly to e-learning - language applications, virtual learning, various video conferencing tools and online learning software are on the rise.

Just like other universities and educational institutions in the world, University "Goce Delchev" in Shtip needed to change the traditional way of education into a modern way of learning - e-learning. Distance and online education has become the only way to continue the educational process for a large number of students. The Moodle platform provided access to learning content, course creation, forum communication, assignments, and many other activities that contributed to the creation of a new image in education - and this applies not only to students but also to professors as main stakeholders in the educational processes [4].

The experience of the whole year with distance education in the first place highlighted the challenge of discovering the activities of students and professors during the pandemic and before the onset of the pandemic. For that purpose, an analysis of the activities of all users of the Moodle system was made. Hence the need to obtain results that will determine whether and to what extent there is a difference in the increase of the activities of all users of the e-learning platform. This change during education can also generate changes in the way of education from previous years. Thus, with this paper, we have tried to capture the existence of such changes. Considering the above-mentioned aspects, we believe that the transition to exclusive e-learning can greatly affect the educational process, so we made an analysis of the overall activities of professors and students before the onset of the pandemic and the onset of the pandemic. From the obtained results, we have selected certain modules from the total activities, in order to find out where and how much the activities of the users are increasing. Quizzes, forums, assignments, surveys, lessons, and glossaries are just some of the modules available on this platform that we have analyzed. These modules enrich the learning opportunities and enable a number of new activities that create a new environment for the realization of the educational process.

2. Using Moodle during Covid-19

The Covid-19 virus pandemic began in March 2020, opening up a global crisis in all areas, including education. The global pandemic Covid-19 in parallel with the global health crisis created a global crisis in education, with 82% of students in the world no longer with traditional education programs, and UNESCO recommended learning online [5].

Like many other industries, the education sector is strongly affected by the Covid-19 pandemic. On March 30, 2020, ITU News (ITU, the United Nations Specialized Agency for Information and Communication Technology) announced that 165 countries had closed schools nationwide, affecting more than 1.5 billion children and youth (ITU News, 2020), according to UNESCO sources - Scientific and Cultural Organization of the United Nations [6]. There is also great uncertainty about when the schools will open. Fortunately, these days there are many free (or inexpensive) easy-to-use digital communication tools that provide a significant number of distance learning solutions [7].

Designed to offer students, teachers, and administrators a system that can help them create an enhanced and customized learning climate, Moodle is considered as a web-based flexible learning environment that facilitates collaboration between users [8]. Through this platform, teachers can upload and supply students with information and resources to which they would not have had access during face-to-face classes, and students can easily share information, state their difficulties and receive feedback. Thus, Moodle includes diverse features such as forums, chats, private messaging, and higher education institutions can use it as an additional method to traditional education, or for exclusively online learning.

The Moodle platform facilitates access to learning content, course creation, forum communication, assignments and many other activities that contribute to creating a completely new picture of the learning process - and this applies not only to students but also to professors as main actors in the educational processes. This system for managing learning materials has become widely used in education, from primary schools to universities, thus becoming the new everyday in the education process in order to address the consequences of the closure of educational institutions. The purpose of Moodle itself can be seen as an addition to traditional classroom teaching, but also for creating dynamic online learning communities, as well as for creating a large number of courses in a single system.

This platform is widely used worldwide by universities, communities, schools, instructors, courses, teachers and even businesses. The great success of Moodle is also due to the fact that the system is available to your code developers in various parts of the world to contribute new applications for the program; that is why this system is today one of the most used ones in courses in distance learning.

The great popularity of this tool is mostly based on a very simple and fast installation, low demands on the resources of the computer on which it runs, easy integration into existing systems and a pleasant and intuitive working environment even for beginners with little or no experience with similar applications.

Moodle is a great tool for the teaching process because it is a platform for creating and preserving teaching material, and it also enables easy collaboration over the Internet between professors and students. The tools owned by the Moodle platform help to make teaching more efficient. Thus, the implementation of information and communication technology in education with e-learning enables the improvement of the effectiveness of education.

3. Methodology and tools used

The Hortonworks platform was used to analyze the activities of the Moodle users. It is a big data management platform that provides a centralized architecture for running indirect, interactive applications in real-time, in parallel with distributed data sets. It is built on the Apache Hadoop project and supports a comprehensive set of tools that address the basic requirements for security, business, and data management. The Hortonworks data platform offers download and installation of the Hortonworks Sandbox system on their official website[1]. The only prerequisite is to have VirtualBox, VMware or some other virtualization software installed beforehand. From HortonWorks platform, we used the Sqoop and Hive tools to meet our goals.

Sqoop is a tool which is used for data transferring between Hadoop and relational databases. With Sqoop we can import data from a relational database management system (RDBMS) into the Hadoop Distributed File System (HDFS). It can be also used for data transferring in Hadoop MapReduce and for exporting data back in RDBMS.

Apache Hive is a tool that is used for storing and processing a large amount of data (big data). Hive provides something called HiveQL which is SQL-like query language for performing big data queries. It can be easily integrated with existing tools using the JDBC or ODBC interface. Hive can organize data from different sources and provide users with the ability to search, structure and analyze big data.

In Figure 1, we can see the flowchart of all activities for Moodle data analysis. First, we imported the Moodle database into MySQL. In the next step, using the Sqoop tool, we imported the database tables from MySQL to HDFS. Afterwards, using a Hive query, we imported only the following useful tables: mdl_logstore_standard_log, mdl_users, mdl_role, mdl_role_assignment in Hive. In this research, we only used mdl_logstore_standard_log table which contains records of all users' activities. We plan to extend this research in future, and that is the reason why we imported all these tables. In the last step, we analyzed user activities with the Hive tool.

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[1] Get Started with Hortonworks Sandbox, https://www.cloudera.com/downloads/hortonworks-sandbox.html
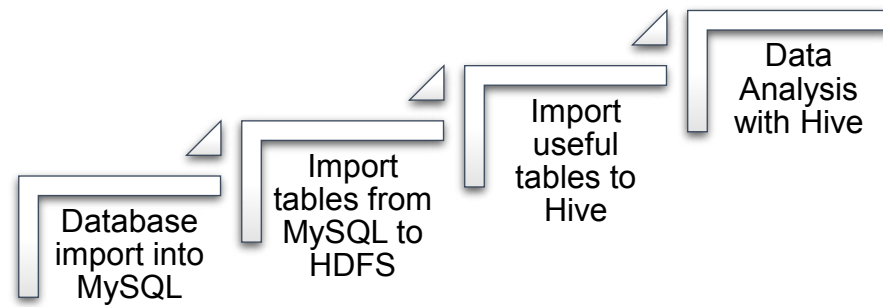
Figure 1 – *Flowchart of all activities for Moodle Data Analysis*

4. Results

Although online learning through Moodle was an integral part of studying, with the outbreak of the Covid-19 pandemic and the closure of universities, the entire study process was moved to electronically implemented study. Although some of the disadvantages of online education include the complex use of online platforms and software and the need for technological knowledge, the acquisition of new knowledge through the Internet has not changed the principle of education itself. The educational process still required students to perform their duties such as homework, seminar work and taking exams. The interactive relationship between professors and students, and all modules such as quizzes, assignments, surveys and lessons are just some of the activities that enabled the realization of the educational processes. This has increased the use of the Moodle platform. The Moodle platform provides access to professors' lectures. The professional literature is also available in an electronic form, and the professors are continuously recording additional materials and updating new teaching videos.

The graph in Figure 2 shows a parallel comparison between the monthly activities of the Moodle platform from March 2020 with the outbreak of the pandemic and the closure of universities and 2019, when the educational process took place with physical presence. It must be noted that these are the total activities of both professors and students.
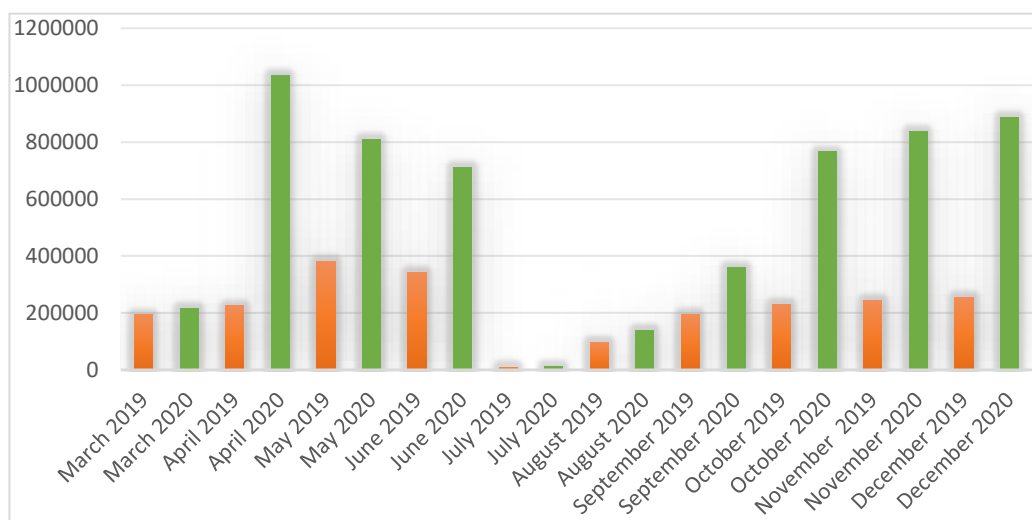

Figure 2. *Difference between Moodle activities in the pre-Covid-19 pandemic period and during the pandemic*

March 2020 was taken as the key beginning of the pandemic and it also represents the beginning of a new way of functioning of the educational process. Parallel by months, the biggest difference is between April 2020 and April 2019. It can be noticed that the activities have increased up to 1,000,000 in April 2020. The months of July, August, September and October do not make much difference due to the end of the previous academic year and the beginning of the new academic year. In November and December the number of activities is also increased because the academic year continued to run electronically, using the Moodle platform.

Figure 3 shows a comparison of the total activities of Moodle users between 2019 and 2020. It can be noticed that in 2020 there is about 3 times increase in activities.

Once the monthly and annual analysis of the total activities was done, the next step was the analysis of Moodle activities for different components such as: forum, quiz, assignment, choice, book, chat and glossary. All these activities are contained in the table *mdl_logstore_standard_log*. This spreadsheet contains records of each activity of Moodle users. From the table with the total users' activities, the total number of activities of all users for the respective modules was extracted. In other words, the data processing set contains information on the number of activities in the examined modules.
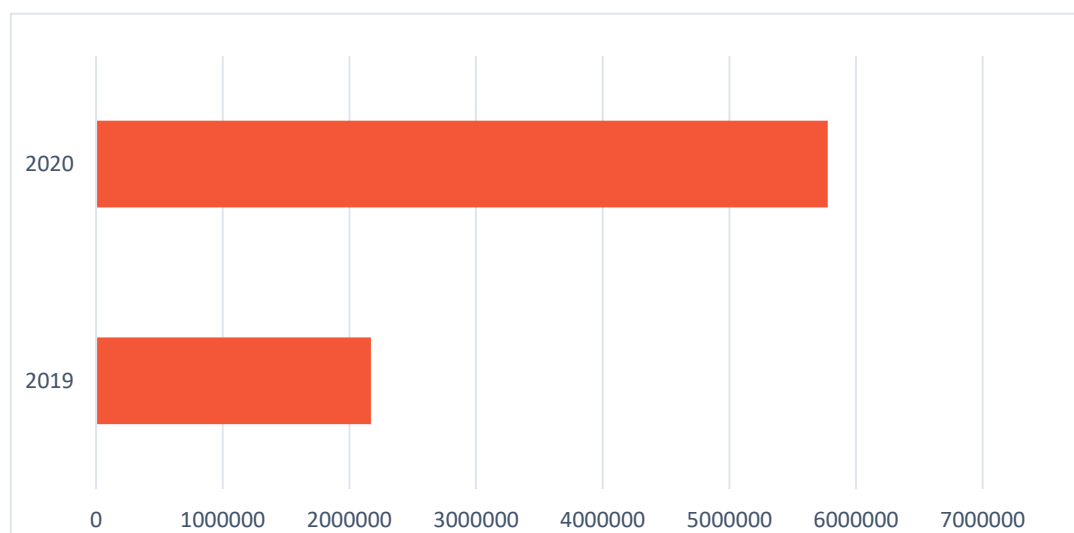
Figure 3. *Difference in terms of total annual activity of Moodle users*

In Table 1, we can see the difference of annual activities for different modules.

Table 1 - *Difference in Moodle activities for different components on an annual basis*

Year	Forum	Quiz	Assignment	Choice	Book	Chat	Glossary
2020	250 380	2 030 404	1 706 870	10 818	9 325	75 876	6 503
2019	34 615	240 932	168 321	6413	7 398	6 128	4 932

The *Forum* module indicates the number of forum activities and the number of activities that involve active participation in communication. It is one of the modules with the highest growth during

the pandemic, the difference before the pandemic and with the appearance is even over 200,000 activities. Due to the pandemic, most of the notifications are posted on the forum.

The *Quiz* module usually contains questions and their answers. Most of the professors reduced the way of assessment through electronic quizzes and tests. Although until the previous year electronic tests were current, in 2020 they became necessary for student assessment and successful completion of semesters. The way the quizzes work is that students can answer by choosing from several suggested answers, answer by choosing from true/false, or some questions need to be answered specifically. In addition to the above, questions can be defined in such a way that they need to be answered in the form of an essay. All these options allow the choice of how to create exams by professors, which contributes in contrast to almost 2,000,000 activities.

The *Assignment* module contains activities of the professors who set tasks, i.e. they set a problem for which the students are in charge of finding a solution. In that way, the professors evaluate the presence of the students in performing their homework. Physical presence and homework has now been emigrated by electronic homework of all kinds. Therefore, we can notice that the number of activities in the Assignment module has increased to 1 000 000.

The *Choice* module - the teacher asks a question and specifies a choice of multiple responses. We can see an increase in these activities because they can be useful as a quick poll to stimulate thinking about a topic; to allow the class to vote on a direction for the course; or to gather research consent; it can be noticed that there is a slight increase in the number of activities in 2020.

The *Book* module also has a higher number of activities for 2020. As libraries were closed, books and all necessary learning materials were placed electronically. Although until the previous year many of the professors used e-books and learning materials, still in 2020 there was a significant increase. Uploading and using e-learning content is an inevitable process for studying in time of pandemic.

The *Chat* module represents the number of realized conversations. Due to the observance of the measures and the maintenance of social distance, mutual communication between professors and students is limited. The activities in this module have increased in 2020 by 70,000, compared to 2019.

As with the previous modules, an increase in activity can be seen in the *Glossary* module. This module allows users to create and maintain a list of statements, like a dictionary. Here the difference in activities between 2019 and 2020 is around 2000.

The results obtained from this analysis show the differences between the components of the total activities of the users. A large difference can be seen in the components such as quiz, forum and assignment. The quizzes are with an increased difference because all the assessments by the professors were conducted electronically. Informal communication has contributed to the increase of the activities of the components such as a forum, where all the activities that include communication between users are written. There is an increase in the activities of the Assignment мodule because it allows teachers to collect work from students, review it and give feedback, including grades.

5. Conclusion

Education has never faced a situation as the one we are facing now. The crisis caused by the spread of the Covid-19 pandemic has highlighted the needs and challenges to ensure the right to study in such conditions. The results shown above, in addition to showing the difference in the activities of the Moodle platform, also represent the results of how the outbreak of the Covid-19 pandemic has affected education. According to what can be seen from the results obtained in 2020, we have increased the total number of activities by about three times. We will focus our next research on determining the number of activities that apply only to professors and only to students, respectively.

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