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## LEARNING ANALYTICS IN MOODLE LMS: AN INTEGRAL PERSPECTIVE

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**Abstract:** In the digital age, online learning platforms have revolutionized the way in which education is accessed. Among the different LMS platforms is Moodle, which has emerged as a tool widely used in educational institutions around the world. However, simply providing online content does not guarantee effective learning. The analytics of learning in Moodle has emerged as a crucial field to understand and improve the educational experience of online courses, since on the ground it facilitates the administration of courses, but also generates valuable data on the interaction of students with the contents and the activities. In this article, we explore different perspectives of the analytics of learning in Moodle, its importance and its impact on teaching and learning.

**Keywords:** Analytics, Learning, LMS, Moodle, Evaluación.

## INTRODUCTION

Data analytics is a process that involves several steps such as: the compilation, processing, analysis and interpretation of data sets that will be used to obtain valuable information, which will help identify patterns, predict trends and relationships, and finally help to make informed decisions. This practice is applied in a variety of fields, such as business, science, technology, research and, of course, education, to obtain knowledge that will help improve performance, optimize processes and predict future results.

Data analytics is based on the use of tools and statistical, mathematical and computational techniques to explore large volumes of information. As the amount of data generated increases exponentially, data analytics has become essential to extracting value from this data and converting it into actionable insights.

Some fields where data analytics are strongly applied (CIDEI 2023):

- Business Intelligence (BI) or business intelligence
- Business Analytics (BA) or business analysis
- Data Science or data science.
- It advances in each one of these levels in terms of contribution and complexity, from a descriptive level, going through explanation, diagnosis and prescription.

Some of the key concepts of data analytics are listed below:

- **Data collection:** It involves the collection of relevant data from different sources, such as computer systems, sensors, mobile devices, social networks and more. These data can be structured (organized in tables) or unstructured (text, images, videos).
- **Data Processing and Cleaning:** The data collected a menudo contain errors, duplicates and noise. The cleaning and pre-processing process is essential to ensure that the data are reliable and consistent before carrying out the analysis.
- **Descriptive Analysis:** This step involves the initial exploration of the data to understand its structure, distribution and characteristics. Graphs, statistical summaries and visualizations help to obtain a general view of the data.
- **Exploratory Analysis:** In this phase, deeper analyzes are carried out to discover patterns, trends and relationships. This can include correlation analysis, clustering and principal component analysis.
- **Predictive Analysis:** Statistical models and machine learning algorithms are used to predict future outcomes based on historical data. This can be useful in fields

such as marketing, finance and medicine to predict behavior or results.

- **Prescriptive Analysis:** This type of analysis suggests actions and decisions to achieve certain objectives. It combines historical data with rules and algorithms to recommend the best action to follow.

## **DEVELOPMENT OF THE INVESTIGATION**

### **PROBLEM PLANNING**

Moodle is an open source learning management system, which has transformed education to allow the efficient creation and management of online courses. However, the simple migration of content to an online platform does not guarantee optimal learning. Here is where data analytics comes into play, which we will call learning analytics, since it focuses on education, which refers to the compilation, processing and analysis of data generated by students and their interaction with the learning environment digital.

Does the use of learning analytics allow for the timely attention of students at risk and avoids their dropout?

### **JUSTIFICATION**

It is desirable that all teachers, tutors or administration of any educational institution, who by their own function must carry out different types of assessments, recognize the importance that has the use of the analytics of learning, are going to allow students at risk if detected in time and be able to provide them with a timely action plan forwarded to their regularization and consequently ensure their continuity in the educational program.

The Moodle open source LMS platform has been a cornerstone in online education, providing a versatile and customizable platform for creating and managing online

courses. However, the real innovation lies in its ability to compile and analyze data generated by students while interacting with course content and activities. The analytics of learning in Moodle leverages this data to provide valuable information to educators and course designers, allowing them to make informed decisions to improve the educational experience.

### **THEORETICAL FRAMEWORK**

In this part of the article, we will address the concepts of analytics, data, LMS Moodle, activities in Moodle, resources in Moodle and data analytics in Moodle.

The analysis is the process of discovering, interpreting and transmitting important patrons present in the data. In a simple way, the analysis allows us to see important statistics and data that we could otherwise miss. The business analysis is dedicated to using the statistics derived from the data to make more informed decisions that help organizations to increase sales, reduce costs and improve other business questions (Oracle, 2023)

The main objective of the records (data) is to provide useful information about prevalence, evolution, results and needs. The records must fulfill a series of characteristics, such as validity, accuracy, reliability and quality. It is considered that a registration is valid if there is a percentage of compliance of the same that is of 90%. The lost data can respond well to problems of interpretation of the program (poorly defined concepts: need to standardize the classification of the data) or to problems of who introduces the data (insufficient information) (Planas, M., Rodríguez, T., & Lecha, M., 2004).

Según Peña Matos, Maximino, & Dibut Toledo, Lázaro Salomón (2021), Moodle was created by Martin Dougiamas. He based his design on the ideas of constructivism in pedagogy which states that knowledge is

constructed in the mind of the student rather than being transmitted without changes from books or teaching and cooperative learning. It is said that Moodle, is a web application of the Virtual Educational Environment type, a course management system, freely distributed, which helps educators to create online learning communities.

In Moodle's language, activities are the ways in which students interact with a course. Questionnaires, glossaries, forums and assignments are all commonly called 'activities'. The resources are elements that you can use to expand the training. They can be documents or presentations, or even an external web page, for example, a particular YouTube video (ISPRING, 2023).

Understanding the key concepts, we then see a definition of what the learning analytics is: "The learning analytics is the measurement, the compilation, the analysis and the report of data about the students and their contexts, with the aim of understanding and optimizing learning and the environments in which it is produced" (Habeab, O.A., 2019)

In today's world, driven by a large amount of available data, teachers, tutors and administrators of educational institutions are continually looking for new ways to improve their eLearning courses and programs. The Moodle platform offers learning analysis tools to help optimize and improve the students' learning experience so that better results can be achieved for both students and institutions.

## METHODOLOGY

For the realization of this investigation, TecNM / Instituto Tecnológico de Pachuca was considered, in the courses of Degree in Administration and Engineering in Computational Systems in the distance and face-to-face modality, since many professors use the platform to distribute study material and that students carry out various activities

such as: exams, tasks and forums mainly. The analysis was carried out during the semester in June 2023 with different groups of 24 teachers who participate both in the area of distance education and in the face-to-face modality. The sample considering a confidence level of 95% and a margin of error less than 5% must be at least 23 teachers. These values were obtained using an online margin of error calculator taken from <https://es.surveymonkey.com/mp/margin-of-error-calculator/> which can be seen in Figure 1.

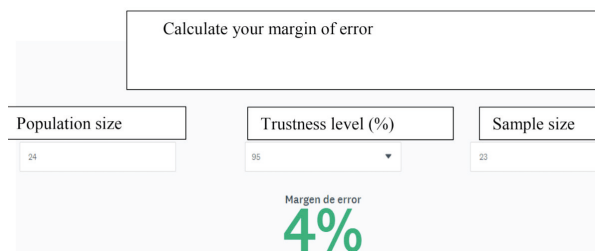


Figure 1. Confidence level and margin of error

The teachers impart different assignments from the aforementioned careers, all of them using the Moodle platform both to publish their studio materials and to carry out activities on the part of the students. Derived from the evidence that is delivered, value judgments (qualifications) are issued based on the levels of competence achieved by the students based on the designed evaluation instrument. Each teacher serves an average of 30 students for each subject or assignment.

In this study, 50 groups are analyzed that serve the 24 teachers in order to apply data analysis to obtain data that allow to determine how many, who and what courses are the students at risk.

## DATA COMPILATION

The institutional Moodle platform has enabled the plugins for the learning analytics, in Figure 2 the options can be seen.

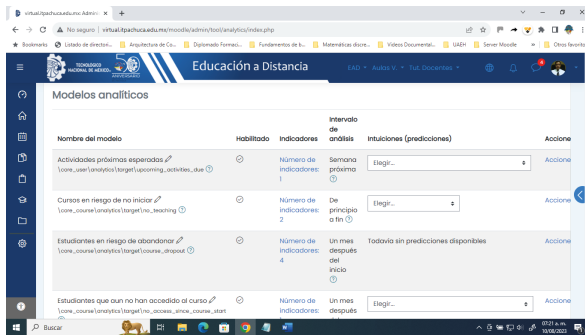


Figure 2. Learning analytics options in Moodle

To start with the compilation of information, the option “Students who have not recently accessed the course” was chosen. Figure 3 shows the result of the learning analytics, in this case the General Accounting course is taken as an example. This process is repeated for each analysis group.

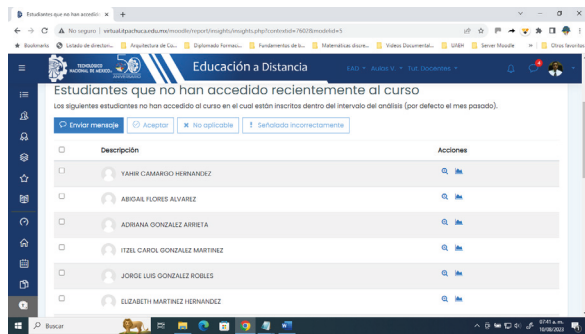


Figure 3. Sample of students who have not accessed the course recently

After carrying out the aforementioned learning analysis in the 50 groups, a total of 83 students were obtained at risk for not regularly enrolling in the course during a month after starting the semester.

## DATA ANALYSIS

The information obtained from the Moodle learning analytics, was first revised to carry out “data cleaning”, and it was decided to eliminate the repeated students, leaving a total of 71 students.

On the same Moodle platform, the Preliminary Report for each of the students is reviewed by the teachers who correspond to the assignment of the course where information is analyzed about the behavior of the student in relation to the realization and delivery of programmed activities. In Figure 4 you can see an example of Preliminary Report.

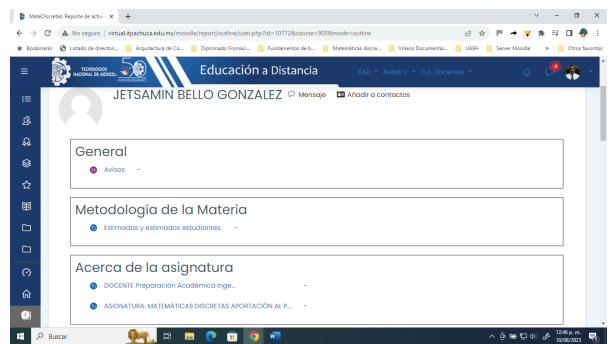


Figure 4. Preliminary report by student

Once the information has been obtained and cleared, it continues with the next stage of the learning analytics process.

## PREDICTION AND FEEDBACK

The Moodle platform records each student interaction with the course content and activities. This allows you to track the time dedicated to each resource, the frequency of access and the general progress, supported by this facility provided by Moodle, each teacher analyzes and reviews the preliminary reports in order to know the academic status within the course of each one of their students, later via e-mail, are notified of their status within the course and the high risk of disapproval of the course assignment in case of non-compliance with the activities scheduled in time and form. In addition, a time of 1 hr/

week was implemented by each teacher for the attention of students at risk of dropping out or dropping out of school, with the result that of the 71 students, 65 of them attended their courses and were regularized in no time at all a month.

## FINAL COMMENTS

### RESULTS SUMMARY

In this study work, the results obtained were really satisfactory due to the fact that, through the integrated learning analytics in Moodle, important data can be obtained for your study and analysis in such a way that, once the data is interpreted, it is possible to timely detect students at risk of I agree with the desertion of the course or the assignment and carry out the relevant actions so that students have the opportunity to regularize themselves and have academic continuity.

### CONCLUSIONS AND RECOMMENDATIONS

It is evident that the use of strategies for any activity such as this case study for online evaluation is extremely important in

the evaluation process, whether formative, summative, diagnostic, intermediate or final, qualitative or quantitative, to allow a design of assessments according to those that the student intends to know, but at the same time that the students see it as a moment in which they must test their knowledge and skills and recognize their achieved levels of competence, receiving their respective feedback which must contribute to its improvement and reinforcement of knowledge in students.

On the other hand, the information generated through the evaluations will allow the teacher a deferred feedback to the students and a point of reflection of their teaching practice in terms of the teaching strategies employed. The analytics of learning in Moodle also provide information about the commitment and participation of students in forums, discussions and other collaborative activities. This allows teachers to encourage interaction and active participation. Through the analysis of historical data, it is possible to identify patterns of behavior that could predict academic success or failure. This allows educators to intervene in time and provide additional guidance when necessary.

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