A Moodle Component for Data Visualization with Applied Learning Analytics for Students

M. Barbachano-Chiu[a], V. Menéndez-Domínguez[b] and L. Curi-Quintal[c]
Universidad Autónoma de Yucatán, Mérida, Mexico

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Abstract: One of the main characteristics of e-learning platforms, such as Moodle, is the registration, monitoring, and storage of the interaction of its users with the published resources, access, and times of entry and exit to them. This information certainly occupies a lot of space and, since its analysis requires prior knowledge by teachers, this information is often forgotten and even eliminated. For this, through Learning Analytics, whose main objective is to apply an intelligent use to data produced by students to predict, evaluate and optimize their learning, we have proposed the development of a Moodle component that allows, with the help of data visualization, to present different results obtained through different learning analytics techniques to evaluate the academic performance of a student or a group enrolled in a course through parameterization, visual and quantitative support by the tool.

1 INTRODUCTION

In recent years there has been an increasing interest in educational data analytics, which is not a new area of research as in previous years it has been referred to as learning analytics (LA). Learning analytics has been described as an emerging field where sophisticated analytical tools are used to improve learning and education (Koedinger et al., 2010), especially in learning management systems (Menéndez and Castellanos, 2014).

These tools provide increasingly large amounts of data, which can be analysed to easily address questions that were previously not feasible, involving the identification of differences between groups of students or unusual student behaviours (Romero, Ventura, Pechenizkiy and Baker, 2012). Importantly, the use of this information and analytical modelling allows the prediction of student progress and performance, and the ability to act on that information.

Specifically, there are four categories of learning analytics (Romero and Ventura, 2020):

- Descriptive (What happened?)
- Predictive (What happens next?)
- Diagnostic (Why did it happen?)
- Prescriptive (Do this to improve)

These will be detailed through the following proposal, where we sought to cover each of these categories given the vast amount of information that Moodle stores as well as the need of teachers for tools that offer them support to support their courses and their students' learning.

This paper presents a proposal for the analysis of the data stored in the logs generated by the Moodle platform. The educator through a Moodle component (*plugin*) of block type developed in PHP will be able to observe, through the visualization of data, the information collected corresponding to the interaction time of the students with a resource within a Moodle course.

The teacher will be able to visualise the time spent by his or her group or specific students on the course or expected resource through quantitative data and graphs that visually demonstrate the relationship that the students have had with the resources (What happened?), as well as visualising through a line graph the time spent by each student per day on the course, thus determining patterns according to the days (What happens next?).

[a] https://orcid.org/0000-0002-2712-579X
[b] https://orcid.org/0000-0003-3587-1263
[c] https://orcid.org/0000-0002-8184-9473

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Also across the graphics of plugin is possible observing multiple reasons why some students get better grades or which resources are preferred by students (Why did this happen?), and of course, it is considered important to offer some dynamicity to the teacher to introduce a limit parameter according to the number of accesses and average time so that the plugin shows which students are above or below the limit, showing in green those who exceed it and in red those who do not, thus discovering who to offer more support and even which resources (Do this to improve).

This is how, through this proposal, it will be possible to identify patterns that students follow, allowing the progress of the group to be monitored.

Section 2 includes a review of similar works and the most important concepts. Section 3 presents an overview of the proposed plugin in terms of its architecture and functionalities. Section 4 showed a case study applying the plugin in a Moodle Course. Finally, Section 5 mentions its importance and future work.

2 PATTERN IDENTIFICATION PLUGIN FOR THE MOODLE PLATFORM

Moodle plays the role of a platform that integrates the different possibilities offered by the network, with a view to its use in education. Because it is a free software tool that feeds back on the work done by multiple institutions and participants collaborating in a network, educators have the possibility of freely accessing and incorporating into their subjects multiple modules or components created by other users through elements called plugins of various types (Moodle, 2022). The main ones are described in Table 1. There are currently 1653 plugins that have been developed by 929 developers and grouped into 47 categories (Moodle, 2022).

Moodle enables non-classroom learning for students, facilitating virtuality, and is considered an e-learning tool (Iker, 2008). The e-learning concept has a pedagogical and technological duality, the first refers to the fact that these systems should not be mere containers of digital information, but that this information should be transmitted following pedagogically defined models and patterns to meet the challenges of these new contexts. The second, technological, refers to the fact that the entire teaching and learning process is based on software applications, mainly developed in Web environments (García, 2005).

Table 1: Main Moodle components.

Type	Description
Activity	An activity is something that a student will do that interacts with other students and/or the teacher.
Block	Blocks are elements that can be added to the left or right column or in the centre of any page in Moodle.
Registration	These modules are used to augment ways of handling user registrations.
Authentication	The authentication process in Moodle is initiated when a user clicks the Login link in the UI or if they attempt to access a protected page.
Repository	The repository *plugin* allows Moodle to pull in content from external repositories.
Filters	Filters are a way to automatically transform content before it is displayed.

Given the above, the possibility of using technology with a focus on assessment and the use of tools such as learning analytics will allow teachers to have a better understanding of students' online interactions. With the use of technology, tracking learners from any device accessing a course, as well as course resources, will allow for the collection of information necessary for the presentation of results. The use of the Moodle platform allows users to add a plugin as required in a controlled environment.

Nowadays multiple plugins offer among their features the ability to provide the time a user has spent on a course, obtain the number of times a user has visited a resource, track the whole group based on their times and even qualitative summaries of the actions performed by the students; some of the plugins with these features are "Moodle Course Dedication" (CICEI ULPGC, 2020), "Use Stats" (Fremaux, 2018) and GISMO (Mazza and Milani, 2004).

To convert data from an e-learning system such as Moodle into useful information for making decisions and answering questions in an educational context, a process called educational data mining is presented. This data analysis presents a challenge in devising how to effectively mine these large amounts of information, looking for meaningful patterns and presenting them to teachers and students in a useful way (Kay, Koprinska and Yacef, 2010).

As we encounter the term "learning analytics", we also encounter the term "data mining", whose application in e-learning systems consists of an iterative cycle in which knowledge enters a loop of the system, and in this way will guide, facilitate, and improve learning, not only by converting data into knowledge but also by filtering mined knowledge for decision making. Data mining in e-learning environments consists of 4 steps: collecting data, pre-processing data, applying data mining, and finally interpreting, evaluating and displaying the results (Romero, Ventura and García, 2008).

Learning analytics has similarities with data mining (Baek and Doleck, 2020) of course, also differences but specifically the process to follow is similar (Figure 1). Regarding the previous process, data collection consists of obtaining information on the use that users make of the e-learning platform, in our case Moodle; then we proceed to pre-process the data with the aim of cleaning and transforming this information into a format that allows it to be analysed and synthesised. The purpose of this process is to observe the derived result that gives meaning to the knowledge of interest to the user and allows to obtain results that can be presented to them attractively and understandably, allowing decision making in search of learning improvement.

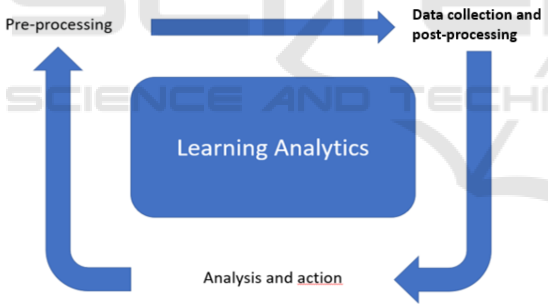


Figure 1: General process of learning analytics.

However, just as we find similarities, it is possible to identify five key distinctions between data mining and learning analytics (Calvet and Pérz, 2015). These are:

- Discovery: In data mining (DM) researchers are interested in automated discovery, and human judgement is a tool for this; in learning analytics (LA) it is the opposite, harnessing human judgement is the goal.
- Reduction and holism: DM reduces systems to components and explores them and their relationships, while LA seeks to understand whole systems.
- Origins: LA seeks intelligent curricula and outcome prediction, while DM would rely on educational software and student modelling.
- Adaptation and customisation: DM performs automated adaptation, while LA informs and trains instructors and students.
- Techniques and methods: DM employs techniques and methods of classification, clustering, relationship mining, while LA focuses on an analysis of learner success, concepts, models of meaning, among many others.

In this sense, graphs provide an excellent approach to exploring information, as well as being essential for presenting results. On the other hand, developments in computer graphics have managed to provide great benefits such as increased quality and accuracy when making these graphs. That said, data visualization is defined as a relatively new term, as it expresses an idea of involving more than just the representation of data in graphical form, but that information should be revealed satisfactorily, concerning quality and different types of information (Chen, Hardle and Unwin, 2008).

In the last couple of years, students have started using Internet to study and due to the easy availability of online courses, student online activities have considerably increased which in turn has generated huge amount of data (Roy and Narayan, 2017).

And given that today, there is no solid theoretical framework for the application of learning analytics in learning managers, the term adaptive learning emerges as a result of joint work between educators, designers and programmers (Daniel, Cano and Cervera, 2015).

This is why we propose the application of the term "learning analytics" in an automatic way through a plugin adapted to Moodle, which allows educators to make decisions based on the data collected by the e-learning system regarding the interaction of students with the platform and presented in an easy-to-interpret interface so that the teacher can apply adaptive learning according to their group and students.

3 PROPOSAL

The proposal focuses on the development of a Moodle plugin (Version 3.6.6) open source, which allows the collection, preparation and transformation of data, as well as their analysis through an automatic and intuitive process to obtain results that help educators to understand the usage patterns of their students, based on their interaction with the course resources. This leads to the presentation of graphs that show the patterns that users follow in a session, generated from the data obtained from the interaction with the various resources proposed by the educator.

Another feature of this tool arises since each teacher has different parameters for grading, observing progress and/or interpreting results according to the subject taught, this Moodle plugin seeks to offer the ability to distinguish students based on different parameters such as time and number of accesses to the course. Given that the teacher can indicate a point of separation for the tool to distinguish students, the tool also offers quantitative and visual characteristics to decide on this differentiating parameter and its value.

3.1 Development Methodology

To develop the plugin, an incremental software development process based on SCRUM (Schwaber and Sutherland, 2011) was carried out through the following stages:

- Backlog: The requirements (functionalities) to be possessed by the component, the results to be obtained and how they are deployed to users are defined.
- First Sprint Backlog: The requirements for the first sprint of 2 weeks are assigned, then we continue with the first sprint where we define the architecture necessary to develop a plugin according to the Moodle specifications (Moodle, 2022) and it is observed that the one that corresponds most is the "Block", as well as the use of the Moodle API "Data Manipulation API".
- Second Sprint BackLog: The beginning of the development is defined to generate the necessary files for the proper functioning of the component.
- Third Sprint Backlog: The start of the tests is determined, as well as the determination of the validity of the data obtained by the component, concerning a course and compared with the results of the calculations obtained manually.
- Finally, the loading of the resulting component on the server of the Faculty of Mathematics of the Autonomous University of Yucatan, specifically in the course called "Human-Computer Interaction (Group B)" - 2019 of the Bachelor's Degree in Software Engineering with a group of 28 students.

3.2 Initial Learning Analytics

A few years ago, Gašević, Dawson and Rogers (Gašević, Dawson and Rogers, 2016) defined which variables, concerning the characteristics of the Moodle learning management system, can provide representative numbers in tools such as quizzes, feedback, lessons and chats. They considered other elements such as forums, course logins, resources and assignments that can simply be used to measure "login" or "non-login".

Our proposal takes into consideration the time that users spend on the resources as an essential element for the analysis of the information, to observe patterns that allow us to relate students' grades to the time spent on the resources and activities. The aim is also to observe which interaction sequences lead to an improvement in learning in the course, whether team members spend the same amount of time on a resource, among many other elements. In the end, it is observed whether there is a correlation between the amount of time spent on a course or resource and the final performance of a student (Kadoic and Oreski, 2018).

Another advantage of the characteristics of the environment where the plugin will be executed is to create an interface that allows different educators (from different areas) the ability to interact with it, without requiring prior knowledge of the development of the plugin. So far, the component allows to know 6 different metrics per group and student for the analysis of information and presentation of results:

- The average time of the group enrolled in a course taking as a time element, from the time a learner enters the course on the platform until he/she leaves the course to enter a different course or logout.
- The average time of the group enrolled in a course taking as a time element the sum of the time intervals per day considering from the time the learner joined the course and logged out or joined a different course.
- The average time of resource use by the group.
- The average time of the group's use of the resource by taking as a time element the sum of the group's intervals on that resource per day.
- The average time of a pupil's use of the resource by taking as a time element the sum of the pupil's intervals on that resource per day.
- The average time per day spent by learners on the course taking as an element of time from entering the course to leaving the course or logging out.

Results obtained allow educators to predict a possible path between the different resources used by students, as well as the progress of each student regarding the assignment of a project or the feedback of a test or quiz (Trcka, Pechenizkiy and Aalst, 2010).

This plugin facilitates the task of educators in analysing large volumes of information through learning analytics and enables improved decision making. By automating this time-consuming and complicated process, it avoids the possibility of complex results that can lead to misunderstandings and incomplete understandings.

Moreover, since data visualization facilitates the correct interpretation of results and the goal of learning analytics is to provide clear information to teachers given the patterns found in the data, both can work together to provide visualizations to represent complex quantitative data for teachers to interpret in various graphs to support improved student learning and adaptive learning processes for students.

3.3 Component Architecture

Software Architecture is a high-level representation of the structure of a system or application that describes the parts that comprise it, the interactions between them, the patterns that supervise its composition and the restrictions when applying these patterns (Pressman, 2006). In general, such a representation is in terms of a collection of components and the interactions that take place between them.

The implemented architecture is called Model-View-Controller (MVC) (Leff and Rayfield, 2001), which contemplates a three-layer structure, separating interface, behaviour and data. This simplifies the implementation and enables the reusability of the developed components. In the architecture, each layer is made up of a collection of components, which, when executed individually or together, enable the required processes to be performed.

This architecture is limited to the API provided by Moodle for the development of new block plugins, as presented in the following Figure 2:

As mentioned above, it was decided to develop a block plugin because of some crucial points, such as:

- The result set must be always at the teacher's fingertips.
- The plugin is required to display course information, so its position is of utmost importance to relate the information displayed by Moodle (resources) to the information calculated by the plugin.
- The plugin should be easily accessible to avoid inconvenience or require specialised knowledge to access it.

When the user interacts with one of the views, the controller detects the change and requests the data from one of the already defined models provided by Moodle through its Data Manipulation API, which were abstracted and manipulated to return results relevant to this plugin.

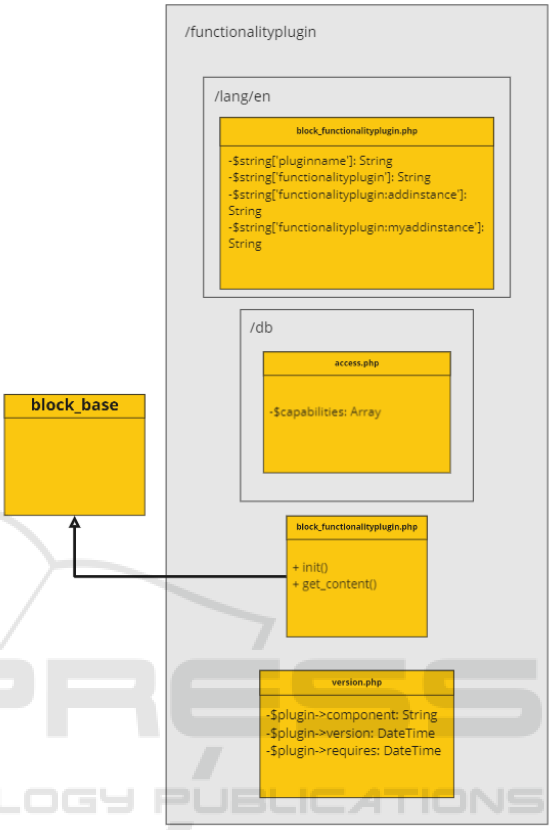

/functionalityplugin
/lang/en
block_functionalityplugin.php
-$string['pluginname']: String
-$string['functionalityplugin']: String
-$string['functionalityplugin:addinstance']: String
-$string['functionalityplugin:myaddinstance']: String
/db
access.php
-$capabilities: Array
block_base
block_functionalityplugin.php
+ init()
+ get_content()
version.php
-$plugin->component: String
-$plugin->version: DateTime
-$plugin->requires: DateTime

Figure 2: Class diagrams of a Block type plugin.

3.4 Component Architecture

Developing a Web application implies an appropriate selection of standard technologies that are freely distributable and independent of any execution platform, which guarantees its portability, availability, compatibility and efficiency (Pressman, 2006).

The main development technologies involved in the plugin are listed below. For each of them, brief information on their role is given (Wandschneider, 2006):

- HTML (HyperText Markup Language) for the creation of the Web pages that make up the visible interface of the component.
- CSS (Cascade Style Sheets) for defining the presentation of a Web page in terms of a specific format and typography. CSS files are referred to as style sheets.

- JavaScript, to dynamically manipulate the different elements of the interface, allowing new interaction styles such as AJAX.
- PHP, for the development of software components, functions and libraries. It is the core language of the Moodle platform.
- SQL language to manipulate the information in the Moodle database.

For data visualization, the D3.js library (D3.js, 2020) is used, which allows easy and competent development of the graphics needed to present the data using HTML, SVG and CSS. D3.js is a JavaScript code library for manipulating data-driven documents, combining powerful visualization components and a data-driven approach to DOM (Document Object Model) manipulation.

Another library used for data visualization; specifically graph generation (Nodes and Edges) is called Vis.js Community Edition, which is called a dynamic visualization library for browsers, designed to be easy to develop, to handle large amounts of dynamic data and to enable manipulation of and interaction with the data (Vis.js, 2021). This library consists of multiple components such as Network, Timeline, Graph3d, Graph2d and DataSet, however, the one used in this case is "Network" which allows displaying dynamic graphs, automatically organized and customizable.

3.5 Access to the Moodle Log

The plugin interacts with the Moodle database through the Data Manipulation API using information from the user enrolments, user, enrol, logstore_standard_log and course tables (Table 2).

The Data Manipulation API has all the functions required to access the Moodle database. It is recommended that these functions are only used for retrieving or modifying database content, as they provide a high level of abstraction and ensure that database manipulation will work with different database management systems while maintaining component compatibility for future Moodle upgrades.

Given a large amount of information obtained from the Moodle database and the processing time to obtain the metrics as well as the graphs presented, it has been decided to automatically store certain results in the browser's LocalStorage, this is a storage space that allows saving small amounts of data in the browser (Mozilla, 2020) in this case of the teacher, to display immediate results (if previously entered).

Table 2: Moodle tables used.

Table	Description
user	This table stores student profile information and in particular the student's unique identifier.
course	This table stores information about the course(s), to which the student belongs, as well as a unique identifier.
enrol	It has the course identifier, together with course information regarding when the course was registered and when it ends.
logstore_standard_log	Stores all the movements made by the student on the platform, together with their respective date and time.
user_enrolments	This table stores when a user registers for a course and their course membership.

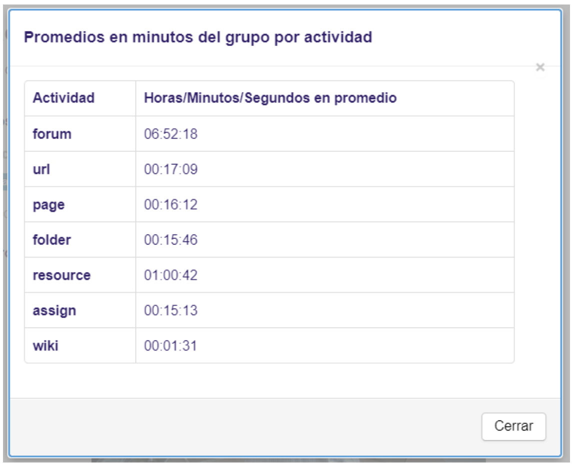
3.6 Component Interface

The web application is the visible interface of our Moodle plugin. In its design, we considered topics of Information Architecture (Morville, 2003): the distribution of textual content, the number of graphic elements, the presence of descriptive menus, the use of links, among others, as well as the recommendations and specifications provided by Moodle (Moodle, 2022). The purpose is to create a functional and aesthetic system in terms of the user interface.

Based on the establishment of the objectives and needs of potential users, profiles that group common needs, experiences and attributes are characterised. This allows the definition of archetypes (Hassan, Iazza and Fernández, 2004) and action scenarios that contextualise a usage situation. As a result, prototypes are developed and validated through heuristics and tests with real users to accept useful proposals. Finally, the system is implemented for use and maintenance.

This allows structuring the whole package with visual consistency and fosters a sense of stability within the application, making it easier for novice users to navigate and explore, speeding up the execution of tasks.

The contents and descriptions have been structured for easy reading and understanding (Figure 3). The images used have been limited both in quantity and variety. The resolution and size were chosen to allow for a reduction in the waiting time for downloading the page without detracting from its significance.


Promedios en minutos del grupo por actividad

Actividad	Horas/Minutos/Segundos en promedio
forum	06:52:18
url	00:17:09
page	00:16:12
folder	00:15:46
resource	01:00:42
assign	00:15:13
wiki	00:01:31

Figure 3: Average time of group per resource.

Regarding the proposed plugin, this is a type of component called by Moodle as a "block", which allows it to be added by the teachers of a course statically, on the left or right side of where the resources of the course are presented. This plugin must be configured within the Moodle administration panel to be viewed only by teachers, preventing students from accessing confidential information of their fellow students.

The plugin acts as an intermediary between the complex processing of the vast amount of data in the system and the user (teacher) in need of quantitative and qualitative data to support decision making.

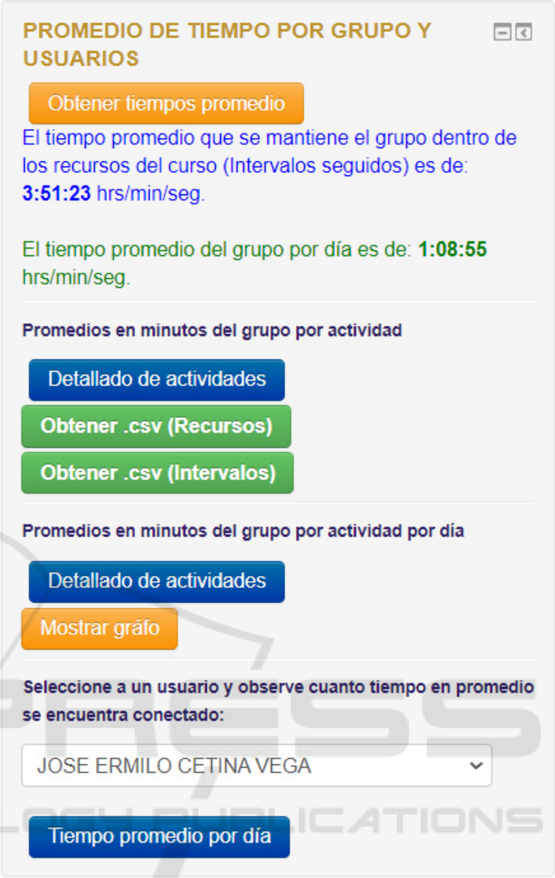
Because of this, the plugin has been composed of several views that allow a simple and easy visualization for the user.

Starting from the main interface, where general information of the group is displayed such as:

- The average time the group is kept within the group's resources.
- The average time of the group per day.
- Download of .csv files with the time intervals of the users per day and course resource.

In this interface (Figure 3), we can observe other functionalities that we will detail below.

The two "activity detail" buttons show the following interface, in which we find the average times of the group per activity (considering as unit of time since the student enters a resource until he leaves one and switches to another) and with the other button the average times of the group per activity per day (in this one we consider as a unit of time the sum of all time that a student entered a resource per day), in these interfaces you can see which are the activities or resources where the students have spent the most time (forums, URLs, pages, folders, resources, wikis).


PROMEDIO DE TIEMPO POR GRUPO Y USUARIOS

El tiempo promedio que se mantiene el grupo dentro de los recursos del curso (Intervalos seguidos) es de: **3:51:23** hrs/min/seg.

El tiempo promedio del grupo por día es de: **1:08:55** hrs/min/seg.

Promedios en minutos del grupo por actividad

Promedios en minutos del grupo por actividad por día

Seleccione a un usuario y observe cuanto tiempo en promedio se encuentra conectado:

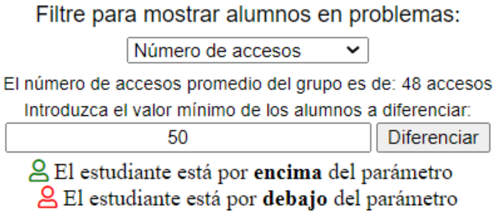
JOSE ERMILO CETINA VEGA

Figure 4: Main interface.

At this point, we have observed how the tool through quantitative data shows us information about the behaviour of the group concerning the resources, however, taking advantage of the use of data visualization and the vast amount of information that Moodle collects, we have been able to develop a relationship graph, whose objective is to relate the resources concerning the users of the course, observing the amount of time spent on each resource per student.

We can observe in this same interface the filtering functionality for students, where the teacher places the minimum value to separate the students in the network (in red when they are below the minimum value and in green when it is equal or greater than the value placed), this can be according to the average time dedicated to the course or the number of accesses to it (Figure 4).

The tool aims to make this task even easier for the teacher by providing the average time and number of accesses of the group to have a reference point.



Filtre para mostrar alumnos en problemas:

Número de accesos

El número de accesos promedio del grupo es de: 48 accesos

Introduzca el valor mínimo de los alumnos a diferenciar:

50 Diferenciar

El estudiante está por **encima** del parámetro

El estudiante está por **debajo** del parámetro

Figure 5: Student filtering functionality by minimum value.

Finally, in the main interface, we find the "Average time per day" button where we can select a student from the group to obtain the average time of the selected student per activity per day as well as the average time concerning the course (Figure 3).

Since this information is only quantitative and its interpretation can be complicated, two graphs have been proposed to allow a better visualization:

Starting from the main interface, where general information of the group is displayed such as:

- The first is a line graph, where the time in minutes that the user dedicated per date to the course is observed (Figure 6)
- The second is the same relationship graph (Figure 7), however, in this case, the main node is the student, and the surrounding nodes are the resources, observing their relationship and time spent with each one of them.

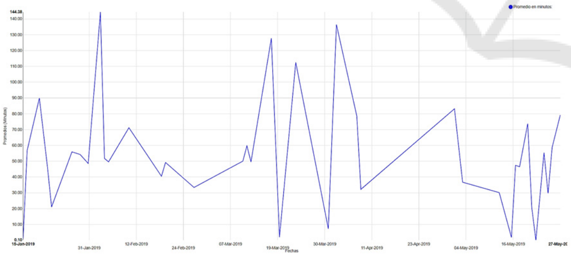


Figure 6: Line chart with average times per date of a selected.

As we have seen, all the interfaces present a similar and intuitive design to guide the user through the interface, allowing them to observe results without the complex task of understanding and analysing the vast amount of data that Moodle stores in its various databases tables.

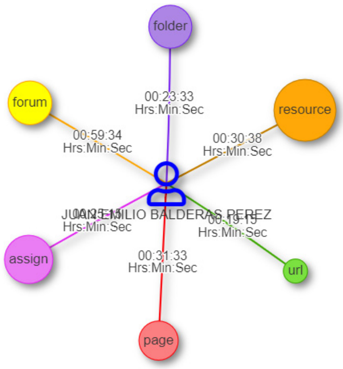


Figure 7: Graph of student-resource relationships.

4 CASE STUDY

The software evaluation process considers two types of assessments to ensure the quality of a product: verification and validation (Pressman, 2006).

While verification is aimed at verifying that the product has been developed correctly, validation evaluates the developed product against the stated needs, i.e., whether the correct product has been built according to the initial objectives.

This case study focuses on the validation of the component, its main objective being to check that the proposed plugin is consistent with the objectives for which it has been developed.

First, the plugin was incorporated into the Moodle course called "Human-Computer Interaction (Group B)" of the bachelor's degree in Software Engineering offered by the Faculty of Mathematics of the Autonomous University of Yucatan in 2019. The number of students enrolled was 28.

The programmed functionalities were validated to ensure that they were available and did not generate errors or affect the performance of the Moodle platform. Subsequently, learning analytics were generated for the group and some students for testing. Some examples of the results obtained are presented below.

The graph is obtained by the following mathematical expression:

$$\sum_{i}^{n}(a_i - b_i) \qquad (1)$$

Where:

- a = Time of entry to an external resource of the course.
- b = Time of entry to a resource in the course.
- n = Number of time slots per pupil per day F.
- i = ith student time slot of day F.

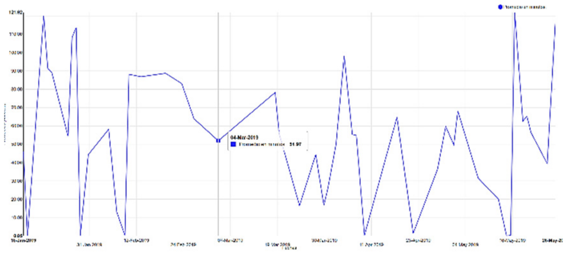


Figure 8: Graph of results generated by a pupil's component.

In this graph (Figure 8) we can see on the y-axis (vertical) the average amount of time a student spends in the course per day, where on the x-axis (horizontal) we observe the days on which he/she entered, this is obtained through the sum of the times per resource occupied by the students per day (mathematical expression mentioned above). With this, we can see on which dates the students spend more time in the course than on other days.

All this allows us to verify that the proposed component fulfils its initial purpose, pending the validation of its usability in an experiment involving potential users.

5 CONCLUSIONS

Learning analytics can be transparently applied in e-learning systems by using components to reduce the need for prior or advanced knowledge. A benefit is obtained by processing the large amounts of information that are stored in these platforms, thus allowing the automation of the process necessary to analyse the information and present the results obtained (Romero et al., 2008).

Likewise, these results can be represented by graphs to identify and observe patterns based on the progress of the students to determine the results of one concerning the group, as well as the improvement of the course through the adaptation of new resources that improve learning.

Results represented by the graphs provide teachers with information about the time their students spend interacting with the resources previously described, allowing them to know the behaviour of the group within a Moodle course. With this, it is possible to continuously monitor the progress that a student can present over the other members of the group (Figure 9).

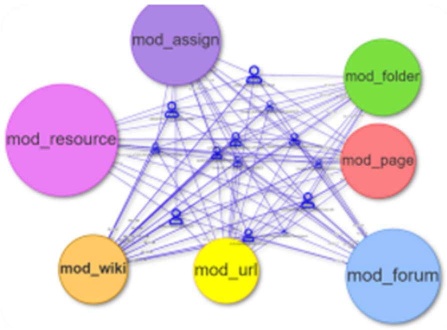


Figure 9: Graph of the students in a course concerning the used resources.

The plugin provides results that favour the planning of new strategies, which can support the high demand for digital activities, to improve student learning.

In addition to providing useful information for the teacher, this last network of relationships allows the introduction of 2 types of parameters to filter the students:

- Filter by average time
- Filter by number of accesses

With this, it is possible to distinguish those students who are below average or above a specific parameter, to be able to offer adaptive learning to their profile.

The COVID-19 pandemic has encouraged computer-based activities that reduce people's presence and education is no exception; distance education in all its aspects and variations is an important alternative to maintain a healthy distance. In this sense, learning management systems become online spaces where all activity performed by the learner is evidenced.

As previously mentioned, our proposal extends Moodle as a tool that offers value to the learning process, incorporating new functionalities that enable an easy and interactive understanding of the results obtained.

By implementing the architecture of a Moodle plugin, the use of the plugin in different versions of the platform is made possible, even favouring the speed of the plugin in terms of its operation. This means that its use by teachers requires downloading and adding it to Moodle through the administrator who manages the platform in their school.

It is worth mentioning that one aspect to improve is to establish the time that a student is connected in Moodle, as in some cases the user does not explicitly log out but closes the browser window directly and this generates wrong values.

In addition, in the latest updates, Moodle has launched a new feature, called Learning Analytics API, which acts as an open system with a wide variety of models and indicators like predictors, goals and intuitions.

The aim is to incorporate these options from the information stored in the Moodle log and to explore new visualization techniques and their application to student groups to evaluate the effectiveness of the proposal in terms of usability.

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