

# The Student's Progress Snapshot a Hybrid Text and Visual Learning Analytics Dashboard\*

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In recent years, virtual learning environments, laptops, tablets and mobile devices have been introduced in the classroom. These technologies start a snowball effect: the old tools teachers used to fathom the students' learning progress, since so much happens online, are not enough. Thus, the need for new tools to analyse the students' activity on the online learning environments arises. The field of learning analytics can provide some of these tools. In this paper, we introduce the Student's Progress Snapshot (SPS), a Learning Analytics Dashboard that allows teachers to analyse the activity of their students on Moodle courses. The SPS running as software as a service, includes both charts and automatically generated explanatory texts of these charts. During the academic course 2015–2016 a pilot was conducted to validate the SPS.

**Keywords:** learning analytics; learning management systems; virtual learning environments; moodle; student interactions

## 1. Introduction

### 1.1 The need to know about the student progress in digital environments

Authors believe that teachers need to know how their students are progressing to be able to tune their teaching strategies, techniques and pace to the specific needs of every group and (ideally) student. Teaching is not a mechanic activity of transferring contents stored in books (or digital repositories) but a really complex process of communication between the teacher and her class. And communication goes both ways through verbal and a whole lot of other channels.

In the past century, pencil, paper, books and blackboard were the basic tools to acquire and generate knowledge. Nowadays our tools in addition to pencil paper and books include: laptops and mobile devices in the classroom, access to the Internet and an endless stream of digital contents and services. This new learning environment unavoidably induces changes. In the theory of Connectivism, Siemens depicts how new technologies change the ways in which we communicate and learn [1]. This learning theory is a useful reflection about the integration of new technologies in education, especially social networks and Web 2.0.

Before the introduction of new technologies in the classroom, the teacher could observe directly how students behaved during school hours [2]. To some extent, the visual observation allowed the teacher to fathom and annotate the progress of every student. The kind and number of questions she asked, visual contact, if she spoke a lot in class, if she rose frequently, if she was not performing as expected,

how she did the assigned work and even the calligraphy and the tidiness of the homework gave clear clues of the performance of every student.

However, these clues may not be relevant anymore to know how the student is performing behind the screen of a mobile device, a tablet or a laptop. Technology has disrupted traditional classrooms mixing physical learning environments with virtual learning environments [3, 4]. Hence a new approach to understand and observe what the student is doing in these mixed physical and digital environments can be really useful for teachers and educators.

In the context of the ESO (the mandatory Secondary Education in Spain for students from 12 to 16 years old) this situation is recent but has already been identified as an issue by educators. Obviously in fully online courses the need to know what is going on has been imperative since their beginning [5, 6].

### 1.2 Learning analytics

Siemens and Long defined the concept of learning analytics (LA) in 2011 [7]. They define Learning analytics as a “cyclical process of measurement, collection, analysis and visualization of data from students and their context, in order to understand and optimize learning and context in which it occurs” [8]. In short, learning analytics is a quantitative strategy that analyses the interactions of students in virtual environments. A student interaction has a very wide scope [9]. In this work interaction is defined as any resource or activity reading, as well as any data submission done by a student in a virtual environment. There is an agreement that the ultimate goal of LA is to achieve

useful information about learning processes and relations among learning agents in order to improve individual and institutional learning and teaching by analysing learning-related data [10].

The most common type of learning analytics is based on the analysis of extracted data from online courses, followed by some sort of reporting and visualization of the data [11]. Nevertheless, it is not enough to retrieve information and knowledge about learning processes and activities but also to transform the data gathered in actionable information [12]. In [13] authors propose a black box technique to predict students' performance. They also propose a set of graphical tools to exploit student's information and provide a meaningful guide to teachers and students.

Conde states that in recent years LA has turned from being a myth into a reality full of possibilities [14], however the level of adoption and maturity of LA tools is still on early stages. Siemens provides a taxonomy with the possible levels of maturity of LA [15]. This taxonomy shows the next incipient stage where data is extracted from VLE's logs and new visualization models use this data to generate useful information about students' progress.

The Siemens and Long definition of LA can be applied for multiple purposes, goals and used by different actors. So, authors find very important to state clearly if our LA final product or project will serve policy makers, school administrators, educative content vendors, teachers, parents, companies that can hire the students in the future or the students themselves. Moreover, it is essential to be clear about our intention and goals. This point is very important when dealing with LA technologies that combine the exponential leverage of information technologies and sensible subjects like education, information about children, etc.

### 1.3 Goals

As stated previously authors want to develop a LA system that will provide the teachers with a set of tools to understand better the progress of their students, so they can adapt their teaching strategies, techniques and pace. If LA information can be used for evaluation purposes and how it could be used is another issue beyond the scope of this paper.

Our target is the collective ESO (Secondary Mandatory Education) teachers who teach children between 12 and 16 years old in Spain.

In Spain Moodle is by far the most used VLE. Most of the public and private schools of ESO use Moodle, sometimes it is provided as Software as a Service (SaaS) by the local government, other times it is hosted in local servers or in a private cloud.

To start with, Moodle provides several plugins to analyse student's interaction with the system.

Nevertheless, these plugins have limited capabilities since it is difficult to obtain a visual global report that provides the teacher with a view of student's progress [16]. This limitation forces the teacher to check several screens, visual reports or tools. Informal observations in the early stages of this research revealed that not all the ESO teachers know how to use the plugins and not all of them understand some of the data presented by these plugins or how to navigate the screens.

These problems reported by ESO teachers are related to difficulties with basic digital competences. It is important to note that many ESO teachers from Spanish educational institutions have difficulties with basic digital competences even more difficulties making sense of what their students do in online learning environments.

Deepening the subject of presenting clear and comprehensive LA information, there are several studies to mention. In [17], a case study that considers the temporal dimension in LA as a possible behaviour measurement to track students in Moodle courses, plus the software tool developed for this purpose is presented in views and charts. Another interesting work is presented in [18]. In their research, authors offer a visual analytics approach to show how student interactions with their resources and peers may have an impact on their academic performance.

Several authors have noticed that teachers have difficulties analysing statistical charts about student's online activity. These authors have proposed to add explanatory text to the charts in order to help teachers interpret them [11]. A learning dashboard is presented in [19] and is a very useful tool for students and teachers alike because it provides a visual overview of student's activities and how he relates to their peers.

Hence our goals for this research are:

1. To provide a single LA tool to analyse the logs originated in the Moodle VLE.
2. To create a student's personal Learning Dashboard, easy to use and understand. This learning dashboard is oriented to help ESO teachers make sense of their students' online activity.
3. To provide additional text explaining the meaning of each chart present in the learning dashboard. This additional text will be generated by the LA tool itself.

## 2. Student's progress snapshot

### 2.1 Overview

The proposal of this research is to provide a unique way to display the student online activity in a Moodle course. We do this by designing and creat-

ing a software tool that extracts data logs from Moodle. The tool transforms these data logs to present it to the teacher as useful information of the students' activity in the VLE. The information is presented to the teacher in what we have named Student's Progress Snapshot (SPS).

This Student's Progress Snapshot has two key components: (1) graphical visualizations and (2) textual information automatically generated by the software.

The SPS in addition to the textual information generated automatically, provides information regarding interactions and tendencies grouped by trimester and compared to the groups progress. These features are missing in other plugins for Moodle as we know.

## 2.2 Architecture

The system has several components working together. The Fig 1. presents a schematic view of the components.

The components of the architecture are:

1. **Extractor.** The Extractor is executed every night to capture incrementally data from the logs in the Moodle Database. The extractor has two viable implementations: (a) accessing the database directly, (b) using the Moodle Web-services. For a production version, the second option is more advisable than the first implementation because it can run on a different infrastructure than the Moodle server. Moreover, since it will run under the security credentials of the teacher it will be more secure and it will guarantee privacy. However, in the pilot we implemented the first strategy to save coding time for more relevant components.

2. **Data warehouse.** The information is depersonalized and stored in a Data warehouse. When the extractor is executed, the data warehouse has a snapshot of the activity of the students up to that moment.
3. **Data Analysis.** The data analysis is a processing intensive activity that for large courses—such as MOOCS—can become quite hard to handle. That is why two design decisions were taken: (1) the data analysis can be parallelized and be set up to be executed in the cloud. (2) The data analysis is only performed when the teacher accesses the SPS. So, if the teacher does not access the SPS for weeks, we will spare all this processing power.
4. **Chart Generation.** The Chart Generation takes the data from the Data Analysis process and generates the charts to be displayed in the user interface.
5. **The Text Generator Engine.** The Text Generator Engine inference takes the Data Analysis and deduces a set of facts to be communicated to the teacher. The facts are compiled into text messages using text templates from a Copy Template Repository. The current implementation of the Text generation engine is a small Expert System, using fuzzy logic inference, that takes the facts from the Data Analysis and deduces a set of facts to be communicated to the teacher.
6. **Web interface.** The web interface allows the teacher to view and navigate the information.

In some cases, the teacher is not able to run the Extractor on her server due to security policies in her centre's infrastructure. For this purpose, we have created a website to allow teachers to participate

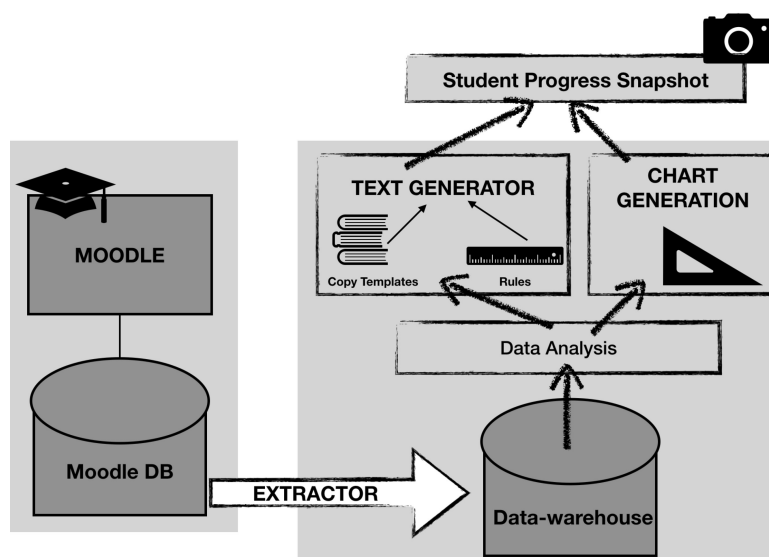


Fig. 1. Architecture of the Student's Progress Snapshot (SPS) system.

**Table 1.** The Student personal data gets encrypted

Input data file	Output data file
"16 of may",22:54,"Daniel Amo Filv�",-,"Course: e-Portfolio con Office 365 (Octubre15)",Records,"Report of views records", "The user with id 'Danel Amo Filv�' viewed the log report for the course with id '79'.",web,215.216.222.234	"16 of may",22:54,573dd283a4022,-,"Course: e-Portfolio con Office 365 (October 15)", Records,"Report of viewed records", "The user with id '573dd283a4022' viewed the log report for the course with id '79'.",web,

in this research. This website is hosted at <http://eduliticas.com>. Eduliticas acts as a SaaS installation of our system and provides the teacher with a way to upload manually Moodle logs.

### 2.3 Privacy and data depersonalization

We need to guarantee student's data privacy in order to comply with the Spanish regulation. So, to maintain privacy and security during the process of data gathering we do not keep any personal data on our Data Warehouse. Following the standards proposed in the DELCATE initiative: the IP address, username, name is stripped from the dataset and used to generate a hash that will be used to identify every student on our SPS. The teacher will receive an email from the Extractor with the list of student's names and hash identifiers and only she will have access to this information. Fig. 2 outlines the depersonalization process.

Table 1 shows a fragment of the input and output of the depersonalization process. In the input file, it can be noticed that the student's name "Daniel Amo Filv " and the IP address "215.216.222.234" appears. In the output file, a hash code has been associated to the students and the IP address has been deleted.

### 2.4 Reports

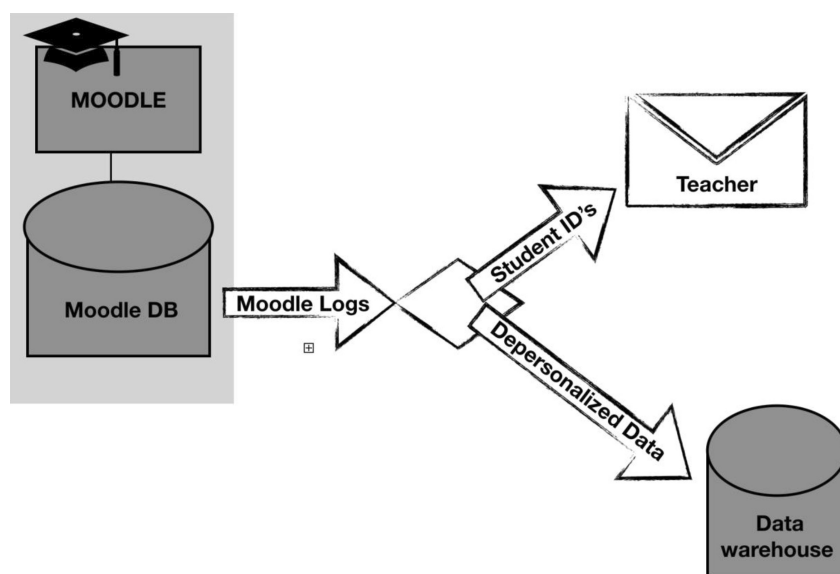
Once the data logs are in the system the SPS consists mainly on a set of reports that the teacher can access using a web interface. Let us remember that we will not display or have data to identify the student, only a hash code will be used to identify each student. The teacher has the information to relate every hash code to each single student.

The first report we find is the Course Report. It is used by teachers to access a single student's analytical learning report (see Fig. 3). The course report is composed of a hash code (on the left of Fig. 3) and several charts (on the right of Fig. 3). Each code links to a student analytical learning report. The charts in Fig. 3 (right) are divided into quartiles so that the dark color signals students with low interaction levels in Moodle courses.

A student's analytical report is organized in four different sections.

1. Summary of student's interactions
2. Trends during the course
3. Detail of the student's interactions
4. Conclusions of these interactions

The first section offers a quantitative summary of student's interactions with Moodle resources and

**Fig. 2.** Depersonalization of student's data.

Total Users 89 | Total Interactions 97.891 | Total Forum Interactions 3 | Total Assignments Interactions 25.482

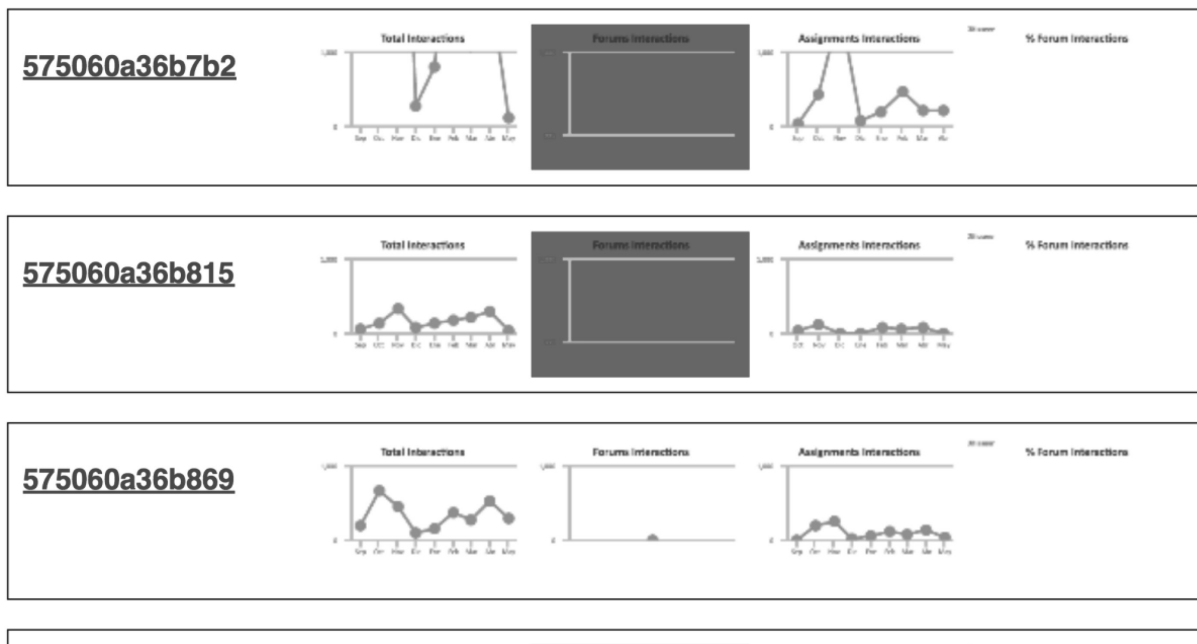


Fig. 3. Course Report. Teachers use the Course Report to access student’s online activity in a Moodle course.

activities. On the left of the image (see Fig. 4) a brief description of the data presented is explained to the user. On the right of the image (see Fig. 4) the quantitative analysis is presented on a table format. Below this table, a text providing basic data interpretation is displayed. This analysis indicates the number of hours the student has worked in the course, the total number of interactions to access resources and activities and a classification.

Continuing with Fig. 4, social interactions include the student’s interactions with Moodle

forums and chats. Activity interactions include the actions performed in tasks and quizzes. Resource interactions include access to pages and documents. The reports on interactions include access to the grade book, user profile or user personal page.

The second section of the student’s analytical report is what we have called “trends during the course” (see Fig. 5).

The table (see the top of Fig. 5) top chart presents a temporal evolution of student’s interactions over the course. To facilitate the understanding of this

## Profile for the student 575060a36bc78

### 1.- Summary of interactions

We call “interaction” to every interaction of the student with the system: accessing resources, reading or posting to forums, participating in Moodle activities (such as delivering tasks or answering quizzes), reading user profiles etc.

<b>Time devoted:</b>	32h 40m	
<b>Total interactions:</b>	1.293	(1.213 lecturas / 80 envíos)
<b>Social interacciones:</b>	0	(0 lecturas / 0 envíos)
<b>Interactions on activities:</b>	200	(181 lecturas / 19 envíos)
<b>Interactions on resources:</b>	0	(0 lecturas / 0 envíos)
<b>Interactions on reports:</b>	320	(259 lecturas / 61 envíos)

A lo largo de las 32h 40m dedicadas al curso el alumno 575060a36bc78 ha realizado 1.293 interacciones de las cuales un 0% son Sociales, un 15% son en Actividades, un 0% son en Recursos y un 25% son en Informes de datos.

Fig. 4. Summary of student’s interactions with Moodle resources and activities.

## 2.- Graphics of interactions and tendency throughout the course

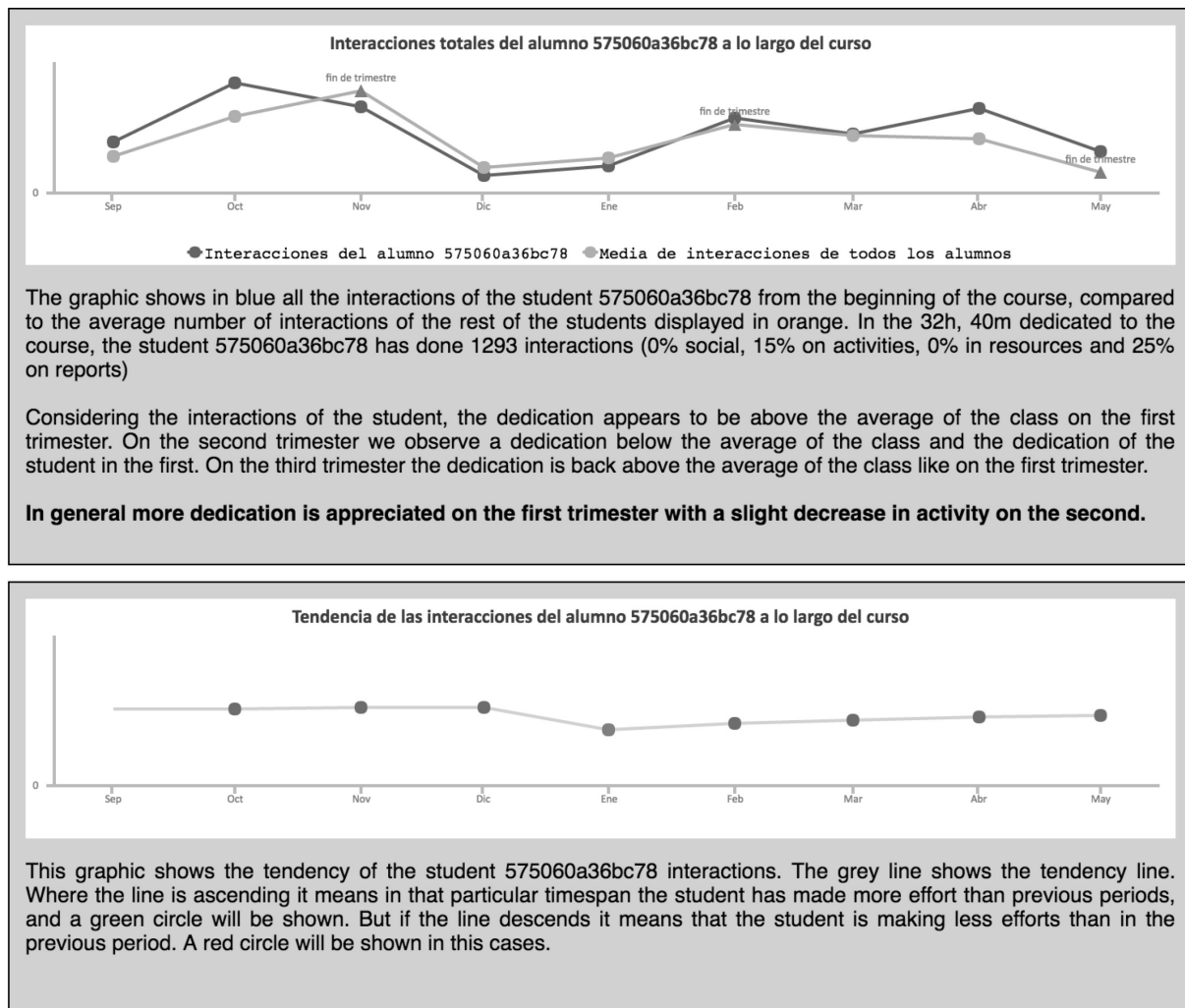


Fig. 5. Student trends during the course.

evolution the statistical trend during the different trimesters and months of the year is calculated. The statistical trend has been calculated by the least squares regression method between the time spent and number of interactions of the student. The chart also compares the interactions performed by the student during each trimester with the rest of the classroom. Below this chart a brief descriptive analysis of the chart is presented in text format. The table (see the bottom of Fig. 5) bottom chart presents the student's monthly activity and the trend.

The third section of the student's analytical report presents information about the tasks a student has performed see Fig. 6). First, a pie chart that separates the actions (read and submit) performed in the assignments is presented. Second a line based chart with the tasks the student has performed every

month is shown. And finally, below the charts, a table details a list of tasks the student has done, and the time spent on each one. The different grey tones codes show the teacher if the student is above the average of interactions in her course (light grey) or below (dark greys). For short dark grey means bad, light grey means good.

Finally, the fourth section of the student's analytical summarizes the conclusions of the previous charts and presents them to the teacher in a textual format.

### 3. Generation of text based explanations of analytical students information

Our system is designed to make easy the interpretation of the data presented in each chart. One way to

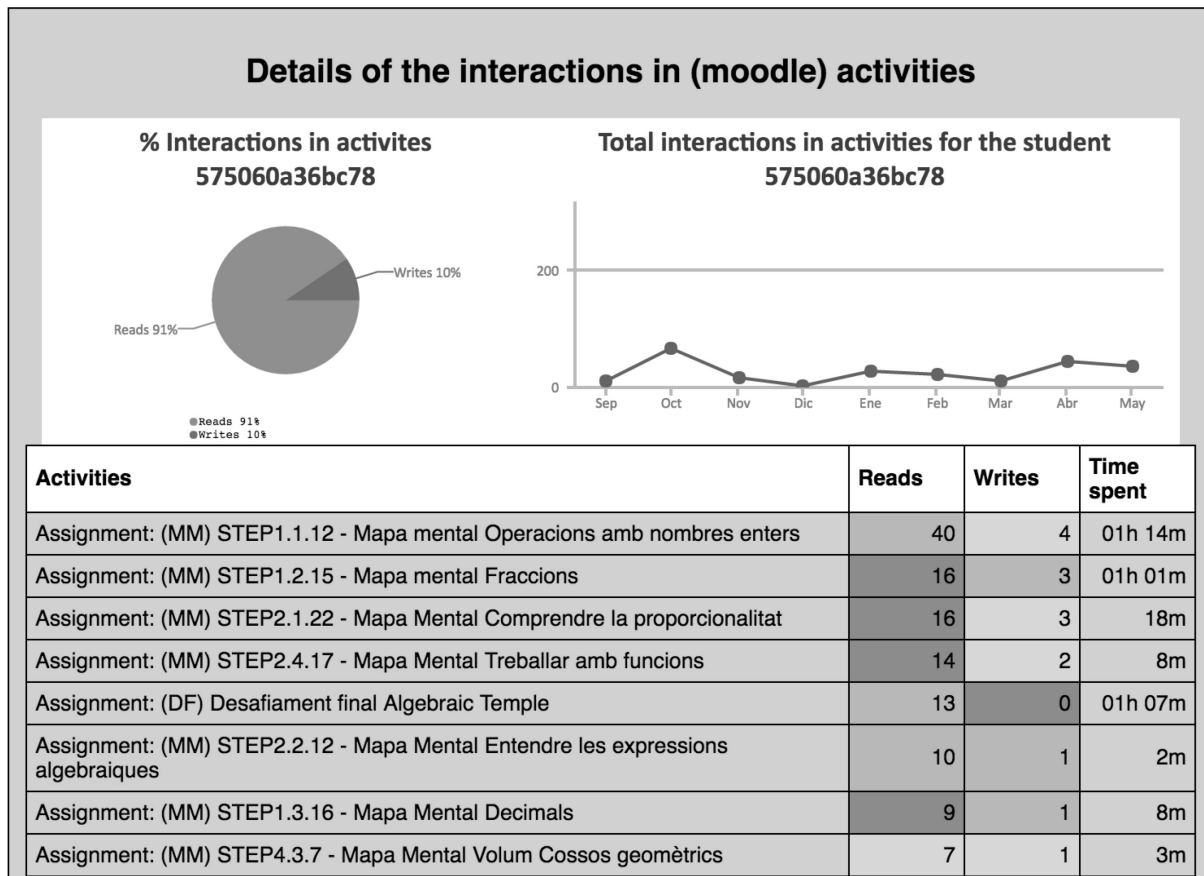


Fig. 6. Details of interactions in (Moodle) Activities.

do so is the selection of colour codes used to deliver results: green is good, orange is average, red is bad.

But in addition to the colour codes, our system provides the teacher with texts explaining the nature and meaning of the information displayed in the pies, charts and tables. Santos et al. suggests the utility of explanatory texts to complement the information displayed in the charts [20].

Thus, our system has yet another component: a text generator. The Text Generator takes the same data as the chart generator, to extract facts about the data (using fuzzy logic operations). An example of fact can be something like “The number of interactions of student X in the Y activity is above the expected threshold”. The facts pass through an algorithm that applying a set of rules will trigger the parameterized messages we want to communicate to the teacher. In the current version, we only address simple statistic comparisons between the group’s behaviour and the performance of the student. In the future, we plan to implement an inference engine to allow for more sophisticated rules and facts.

Once the facts about the data have been inferred, we use a library of templates to generate the messages to be displayed to the teacher. This library could be internationalized.

## 4. Validation

### 4.1 Gathering the opinion of the teachers

To gather the opinion of the teachers about the tool developed, we made a survey. The information gathered from the survey belongs to the last semester of the course 2015/2016. This is the period when teachers are usually very busy with evaluation processes.

Authors have interviewed 30 ESO teachers. 80% of the teachers were male and 20% female, ages between 40 and 65.

The survey presented 32 questions related to the relevance and appropriateness of the various sections of the Student’s progress snapshot. The survey only included questions with Likert scale answers or open answers.

The main sections of the survey are presented below:

- Summary of student’s interactions.
- Student’s interactions during the course.
- Comparison of student’s interaction with the rest. of the group or a subset of the group.
- Division of interactions in social, activity, resources and reports.
- Conclusions of student’s activity.

**Table 2.** Main components of the survey and the reason they were included

Component	Goals
Interactions along the course	Count the total number of interactions during each month of the different year semesters.
Tendency along the course	Identify the months when students do more interactions (work more).
Activities	Identify which tasks have been sent, re-sent and not sent by the students.
Resources	Identify which resources have been accessed and discarded by students.
Social interactions	Identify social relation between students (students who influence others and students that are influenced by others).
Progress by access dimension	Know student's progress based on the access to the VLE resources.
Progress by temporal dimension	Know student's progress based on the time dedicated to each VLE resource.
Comparison	Compare student's behaviour with the rest of the classroom.

We designed the survey to know which elements in the student's progress snapshot were useful for the ESO teachers and which not. Below, the main components included in the student's progress dashboard and the goals we wanted to accomplish using each component are presented.

Next, we present the sections of the survey as well as the questions included in each section and the answer type expected for each question.

The answers gathered from the interviewed teachers have been analysed using descriptive statistic methods. So, authors have not done any data correlation or used any regression models. We have not explained the data distribution based on advanced statistical models either.

Authors have tried to explain the obtained results using centrality measures such as the mean. We have also used dispersion measures such as the standard deviation and percentages to analyse the data concentration in case of high deviations.

The gathered data have suffered a type transformation in order to be able to calculate the mean and standard deviation. A quantitative value has been assigned to questions with a likert answer scale. So, this question answers have been transformed to the following quantitative values.

Each teacher used the tool to analyse their student's progress during the 2015/2016 progress in his Moodle courses. After using the student's progress dashboard, each teacher filled in the survey presented previously.

As mentioned before, the goal of the survey was to validate the students' progress dashboard as a tool to improve tutorship and student's evaluation.

The aim of the questionnaire is to validate SPS as a tool for improving mentoring and/or evaluation. The questions and affirmations are raised about their different visual and textual elements. Consequently, the teacher can respond in relation to this type of tool and its different integrating elements, if its presence is appropriate, if the data provided are relevant—such as totals, summaries, counts or comparisons—and if it feels linked to the different statements.

Table 6 shows in the first column the question number, in the second column the mean and standard deviation of the results obtained from the survey quantitative questions. The table has a third column to show which aspect analyses each question. Authors have defined three aspects: convenience, relevance or vinculation. The Minimum value for each question is 1 and the maximum is 5.

#### 4.2 Analysing the survey results

We have grouped the analysis of the survey results in three blocks of questions. Each block relates to the reports of the SPS that the questions refer. Next, we will discuss the results of these blocks of questions in the survey.

The first section of the SPS (see Fig. 4) provides a table that counts the total number of interactions the student has done in the Moodle course. The survey asks questions about the usefulness and relevance of this summary.

Using a scale that goes from 1 to 5, the usefulness mean of this section is 4.4 with a 0.5-standard deviation. The relevant results are similar with a mean of 4.4 and a 0.44-standard deviation. These measures show little dispersion in the sample and indicate that this view of the student's progress dashboard is useful and relevant for teachers.

Participants in the survey propose to delete from the chart those elements which total count is equal to zero. It means deleting from the report those elements in which the student has not done any work.

While most of the teachers find useful and relevant the summary table, some of them do not find useful or relevant the text that appears on the bottom of the table to explain the table (mean = 4 and standard deviation = 1). Some of these teachers explain that they do not find necessary the text, but that the text could be moved to the summary table to read it more quickly.

The second section in the SPS (Fig. 5) is the Graphics of interactions and tendencies through the course. Using a scale that goes from 1 to 5, the usefulness of the first chart is 4.22 with a 0.66-standard deviation. These results indicate that this



**Table 3.** Survey questions

Section and question	Type of answer expected
<b>Section 1: Summary of interactions</b>	
(1) It is useful to have a table that summarises student's interactions with the Moodle course.	Answer likert scale: totally disagree, disagree, nor disagree or agree, agree, totally agree.
(2) Indicate the relevance level of the summary table of student's interaction with the Moodle course.	Answer likert scale: totally irrelevant, irrelevant, nor relevant or irrelevant, relevant, totally relevant.
(3) What would you add, update or delete from the summary table?	Open answer.
(4) It is useful to have a descriptive text on the bottom of the summary table to explain the results.	Answer likert scale: totally disagree, disagree, nor disagree or agree, agree, totally agree.
(5) Indicate the relevance level of the descriptive text on the bottom of the summary table.	Answer likert scale: totally irrelevant, irrelevant, nor relevant or irrelevant, relevant, totally relevant.
(6) What would you add, update or delete from the descriptive text on the bottom of the summary table?	Open answer.
(7) Add any additional comment.	Open answer.
<b>Section 2: Views</b>	
(8) It is useful to have the chart entitled "Total number of interaction during the course".	Answer likert scale: totally disagree, disagree, nor disagree or agree, agree, totally agree.
(9) It is useful to have a descriptive text on the bottom of the chart "Total number of interactions" that explains the chart.	Answer likert scale: totally disagree, disagree, nor disagree or agree, agree, totally agree.
(10) Indicate the relevance level of the descriptive text on the bottom of the chart "Total number of interactions".	Answer likert scale: totally irrelevant, irrelevant, nor relevant or irrelevant, relevant, totally relevant.
(11) What would you add, update or delete to this descriptive text?	Open answer.
(12) It is useful to have the chart entitled "Tendency of interactions during the course".	Answer likert scale: totally disagree, disagree, nor disagree or agree, agree, totally agree.
(13) It is useful to have a descriptive text on the bottom of the chart "Tendency of interactions" to explain it.	Answer likert scale: totally disagree, disagree, nor disagree or agree, agree, totally agree.
(14) Indicate the relevance level of the descriptive text.	Answer likert scale: totally irrelevant, irrelevant, nor relevant or irrelevant, relevant, totally relevant.
(15) What would you add, update or delete to the "tendency of interaction" chart?	Open answer.
(16) Add any additional comment.	Open answer.
<b>Section 3: Detailed social interactions (activities, resources and reports)</b>	
(17) It is useful to have different colours to identify easily each type of social interaction.	Answer likert scale: totally disagree, disagree, nor disagree or agree, agree, totally agree.
(18) Indicate the relevance level of comparing the student's social interactions with the rest of the classroom?	Answer likert scale: totally disagree, disagree, nor disagree or agree, agree, totally agree.
(19) Which other metric could be useful to compare interactions between students?	Open answer.
(20) Indicate the relevance level of the chart entitled "Detail of interactions in Moodle activities".	Answer likert scale: totally irrelevant, irrelevant, nor relevant or irrelevant, relevant, totally relevant.
(21) The charts of these sections do not have a textual explanation below de chart. Do you think this text should be added?	Answer likert scale: totally disagree, disagree, nor disagree or agree, agree, totally agree.
<b>Section 4: Conclusions</b>	
(22) It is useful to have for each student, a textual explanation that summarizes al the charts	Answer likert scale: totally disagree, disagree, nor disagree or agree, agree, totally agree.
(23) Indicate the relevance level of these conclusions.	Answer likert scale: totally irrelevant, irrelevant, nor relevant or irrelevant, relevant, totally relevant.
(24) What would you add, update or delete from the conclusions?	Open answer.
(25) Add any additional comment.	Open answer.
<i>General questions about a student' progress dashboard</i>	
(26) What should be shown in a chart about student's interaction to help you tutor or evaluate the student?	Open answer.
(27) Indicate the relevance level of knowing the time dedicated by a student in each interaction (task, resource, etc.)	Answer likert scale: totally irrelevant, irrelevant, nor relevant or irrelevant, relevant, totally relevant.
(28) It is useful to compare the student's interactions with the rest of the classroom.	Answer likert scale: totally irrelevant, irrelevant, nor relevant or irrelevant, relevant, totally relevant.
(29) It is useful to compare the student's interaction with a specific group of students from the classroom.	Answer likert scale: totally disagree, disagree, nor disagree or agree, agree, totally agree.
(30) These student's dashboards may help you or have helped you with your tutorship tasks.	Answer likert scale: totally disagree, disagree, nor disagree or agree, agree, totally agree.
(31) These student's dashboards may improve or have improved your tutorship tasks?	Answer likert scale: totally disagree, disagree, nor disagree or agree, agree, totally agree.
(32) These student's dashboards may help you evaluate your students?	Answer likert scale: totally disagree, disagree, nor disagree or agree, agree, totally agree.

**Table 4.** Scale to measure the agreement level of an answer4

Scale	Value
Totally disagree	1
Disagree	2
Nor disagree or agree	3
Agree	4
Totally agree	5

**Table 5.** Scale to measure the relevance level of an answer

Scale	Value
Totally irrelevant	1
Irrelevant	2
Nor irrelevant or relevant	3
Relevant	4
Totally relevant	5

**Table 6.** Results of the survey

Question nu.	Mean/st. deviation	Aspect	Question nu.	Mean/st. deviation	Aspect
1	4.44/0.52	Usefulness	18	4.22/0.66	Relevance
2	4.22/0.44	Relevance	20	3.88/0.60	Relevance
4	4/1	Usefulness	21	3.44/1.33	Usefulness
5	4/0.5	Relevance	22	3.88/0.93	Usefulness
8	4.22/0.66	Usefulness	23	4/1	Relevance
9	3.77/0.97	Usefulness	27	4.44/0.53	Relevance
10	3.66/1.11	Relevance	28	4.5/0.53	Usefulness
12	4/1	Usefulness	29	3.88/1.05	Usefulness
13	3.44/1.13	Usefulness	30	3.88/0.35	Vinculation
14	3.33/1.22	Relevance	31	4.22/0.98	Vinculation
17	4.22/0.44	Usefulness	32	4.22/0.66	Vinculation

chart is useful to teachers although some teachers propose improvements such as showing a maximum and minimum number in the Y axes or a numerical interval to be able to compare different months.

The results for the text that is shown on the bottom of the chart show a mean of 3.77 with a 0.97-standard deviation. This means that some teachers find this text useful and others do not. We have obtained similar results regarding the relevance of this text.

Nevertheless, most of the answers are 4 or 5 (66% in usefulness and 66% in relevance), which means that this text could be improved.

The second chart shows the student's tendency during the course. Regarding the usefulness of this chart, the mean is 4. Some teachers explain that the chart should divide the interactions by types or even write comments such, as the student was ill one day. So, this chart is also relevant and useful for teachers.

Again, we asked about the text below the chart that explains it, there are teachers that find it useful and relevant and others that do not (usefulness = 3.44 standard deviation = 1.13 and relevance mean = 3.33 and standard deviation = 1.22).

Considering these data, it seems that this text is not useful or relevant because the ESO teachers are able to interpret the charts easily. We are considering hiding or showing this text when the teacher requests it.

## 5. Conclusions and further work

In the present research, we have two main objectives. The first one is to create a software tool to provide hybrid graphic and text reports of the student interactions with the VLE (Moodle): The

Student Progress Snapshot (SPS). The second to one has been to conduct a pilot experience to find out if the SPS is useful for the teachers to improve the tutoring and the evaluation of the students.

To create the SPS we had to build software tools like the extractors of information from Moodle and the data warehouse of depersonalized data. These tools can be used as platforms to develop other kinds of analytical tools and make further research, and we plan to open source in the near future.

The results of the survey and the overall experience running the SPS as a SaaS for a whole academic course, has provided us with enough feedback and insight. At this point we are aware of the following points:

- The gathered data and the conversations with teachers tells us that he SPS can be valuable asset for teachers of ESO whose students make a heavy use of the VLE.
- There is plenty room for improvement in the texts generated by the system. The set of analytical facts explained has to be expanded in number and complexity. The quality of the texts generated also has to improve.
- While some teachers find the texts something nice to have, others find it a waste of space. Future versions of the SPS will offer to the teacher the possibility to hide messages or visualizations of a kind, if she feels that the element no longer bears information for her.

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