A POTENTIAL WAY TO OPTIMIZE ELEARNING TECHNOLOGICAL TOOLS USING BIG DATA & LEARNING ANALYTICS

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Abstract: In the information age, one of the most influential institutions is education. The recent emergence of MOOCS is a sample of the new expectations that are offered to university students. Basing decisions on data and evidence seems obvious, and indeed, research indicates that data-driven decision-making improves organizational productivity. The most dramatic factor shaping the future of higher education is Big Data and analytics. Big Data emphasizes that the data itself is a path to value generation in organizations and it is, also, a critical value for higher education institutions. The emerging practice of academic analytics is likely to become a new useful tool for a new era. Analytics and big data have a significant role to play in the future of higher education. This paper attempts an analytical practice about the use of e-learning technological tools to generate relevant information, for the teacher and the students who try to optimize their learning process. This combination of data-processing and analytical learning is an aid to improve significantly higher education and mark the path to follow in the new educational era.

Keywords: ***Learning Analytics, Big Data, Technological E-learning Tools, Learning Management System, Educational Data Mining.***

I. INTRODUCTION

Nowadays, there is a huge amount of data from the students that are accessing Learning Management System (LMS). The increase of students in the new educational systems in distance learning is causing a new trend in the world of education. The recent emergence of MOOCS (*Massively Open Online Courses*) is a sample of the new expectations that are offered to university students. This trend leads to a role change in the behaviour of the different educational agents, where both, teachers and pupils, must conform to the new methods and change their traditional methods of teaching[11]. In this phenomenon nor is it beyond the role of academic institutions that are in the obligation to modify its structures and their information systems to meet the students needs in order to have access to their academic offer.

Is there anything we can do with the vast amount of data provided by students to improve the educational system? Until recently, there were no storage techniques that enable the analytical study of the information present in the Learning Management Systems. Now there are more and more new analytical methods that allow us to deal with the study of these data and infer trends of the use that the students make with respect to the tools available in platforms. The implementation of these analytical methods is possible through the use of powerful new technologies such as Data Mining or Big Data that enable the processing of large amounts of information by searching discover new knowledge that is present in the data. It is in this context that this paper is framed, reflecting, through the analytical study of the data current on a LMS the use of that students make of the tools that are available in a learning platform. This study provides relevant information that will allow teachers to optimize the use of the tools, to deal with in depth of the learning strategies that are currently applied to the university teaching.

II. BIG DATA/DATA MINING: TECHNOLOGY FOR DATA ANALYSIS

The use of technological tools in education in general, and in all levels of the individual learning, has followed such a rapid pace. If something has marked the progress of advanced societies, over the past few decades, has been the remorseless development and massive use of technological tools to manage all kinds of tasks[1]. The processing of the large amount of existing data in the field of education has been made possible thanks to the development of new Information and Communications Technologies (ICT). This development has led to diverse educational institutions carry out an analysis of existing data from the interactions of its students, and draw conclusions that will improve the working environment. To analyze this immense amount of information is beginning to use, increasingly, two treatments or processes known as Data Mining and Big Data. Data mining, also known as KDD process (*Knowledge Discovery Databases*), is a process that allows you to discover hidden information in large volumes of data. In the course of the process it works with data subsets, looking for similar patterns of behaviour or predictive models that can be inferred from the processed data. While its use began with economic purposes, their multiple possibilities have allowed us to extend its use to the field of education. The main methods used and their key applications are[2]:

- *Prediction*: Develops a model to infer some aspects of the data. It is used to emulate the behaviour of students in function of their previous activities and to predict the possible outcomes.
- *Clustering*: Looking for classifying data into groups with the same characteristics. Lets you know common patterns for students who are in the same group.
- *Relationship Mining*: Discover relationships between variables. Allows you to discover associations of activities that can induce a sequencing of the same. It also highlights the most effective pedagogical strategies in the learning process.
- *Visualization:* Allows you to discover trends in the use of educational platforms that are outside of the average of students, known as data noise.

However, with the eruption of MOOCS the online information storage is growing in such a way that the processes for managing this information begin to stay small, causing a serious problem not being able to exploit the data with the necessary guarantees. In order to be able to process such information is necessary to have new methods, being Big Data the last to be applied to the learning area. The term Big Data generates even confusion and is used to associate concepts relating to large amounts of data, sociological analysis, data management capabilities and recently, also, in the education area. Big data can be defined as the digital convergence of structured data found inside databases, and unstructured data flowing from new sources like social networks, mobile devices, sensors, RFID, smart meters and financial systems[6]. Otherwise, the *Mckinsey Global Institute* defines big data as "*datasets whose size is beyond the ability of typical database software tools to capture, store, manage and analyze*"[8]. This method allows, today, that organizations can capture and analyze any data, regardless of what type, how much, or how fast it is moving, and make more informed decisions based on that information [9].

We recognized that there is still got a lot to learn about how to work with big data, just like everyone else. But one thing we know for sure is that the traditional ways of working with data will not lead to success in big data analytics [12]. The variety of information sources, the volume of information, latency of processing, even the basic business models are often all different in the big data space. Someone who recommends using the same old tools under these new circumstances is someone who is outside of the data analysis.

III. WHAT IS MEANT BY LEARNING ANALYTICS?

It is undeniable that the technological E-learning tools have come to play a decisive role in the dissemination of the knowledge. The LMS allows you to capture explicit data through the activity carried out by students from any device and provide a clear knowledge of what is really happening in the learning process in order to be able to meet and enhance the care and the needs of the students. The importance of the LMS has done that many countries are investing their effort in educational systems in order to address the challenges required.

In its review they are using academic analytics working with large data sets and predictive models to practice an institutional data mining to produce intelligent actions. The intelligent actions generated from statistical analyses of different data sources can guide a more efficient use of tools, processes, organizations and institutional culture. In the same way, academic analytics has the potential to create actionable intelligence to improve teaching, learning, and student success to predict which students are in academic difficulty or focusing on specific learning needs [4]. Higher education has traditionally been inefficient in its data use, often operating with substantial delays in analyzing readily evident data and feedback. Organizational processes often fail to utilize large amounts of data on effective learning practices, student profiles, and needed interventions [7].

Something must change to improve the efficiency and quality of higher education. Analytics in education must be transformative, altering the existing teaching, learning, and assessment processes, the academic work, and administration tasks. Analytics provides a new model for university leaders to improve teaching and learning processes and will serve as a foundation for changes. But using analytics requires that we think carefully about what we need to know[5]. Richer data sets, new ways of extracting and organizing data, more sophisticated predictive models, and additional research will drive the evolution of analytics. One of the in demand changes is provided by the use of Learning Analytics. Learning Analytics means

"*the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs*"[10].

Learning Analytics focus on the learning process, using the data provide by the LMS, in several ways:

Analyzing the discussion messages posted to identify the student's risks, transforming the university system or the academic models and giving recommendations to students to improve their habits. This process of learning analytics provides very useful information to both teachers and students. Teachers will also let them know, in real-time, performance of the students and respond, immediately, to the most urgent, as well as, plan better their teaching activities. To the students, on the other hand, allows them to have knowledge of their progress and see if their academic activity is enough to achieve the raised objectives. It should be noted that the use of analytics to describe learning won't

be easy, because we are in the early stages of implementation and experimentation. As the practice of analytics will be refined, universities can place better information into the hands of a greater number of people, enabling informed decision-making.

IV. A CASE STUDY

Therefore, it seems to be useful and prudent focus on the realization of an analytical study, about the employment that teachers have made at one of the platforms of teaching online. In this case study has been taken into consideration the need to evaluate the use of the tools used in the teaching/learning process in an interaction environment related to the combined method of learning known as "*Blended Learning*", that integrates, in a balanced manner, the classroom studies with virtual learning. The target in this analytical study is to improve the prospects of the teachers, not only with training actions, but also in orienting the use of the virtual educational tools most appropriate, in order to develop innovative educational strategies.

IV. I AN ANALYTICAL PRACTICE IN A SPANISH UNIVERSITY CENTER

In September 2005 the process of implementing the Moodle platform began in Educational degrees in the area of education taught in a Spanish university center of studies of medium size, following a "*Blended Learning*" system, which develops an educational process that adapts to the pace of learning for the students at a time and in the place you prefer[3]. Using a rigorous and accepted statistical model, on a representative sample, we have analyzed the use of technological tools that offers the platform Moodle in order to propose to teachers appropriate strategies to create spaces for interaction effective to get the best results in the teaching/learning process. From the analysis of the subjects studied to obtain the teacher's degree, it is possible to find out the total number of accesses made, during the academic year 2010-2011, to each one of the technological e-learning tools which are in the Moodle platform. This total number of accesses is shown in Figure 1:

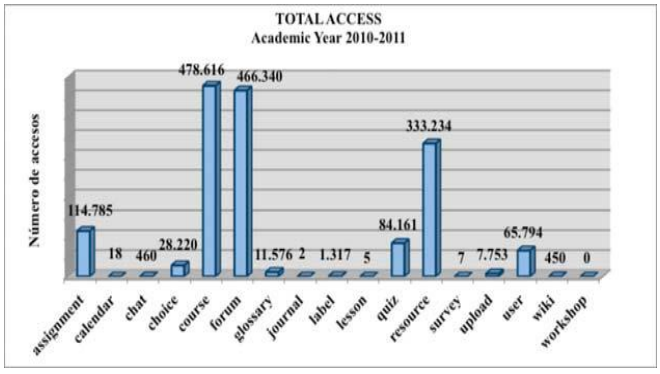

Figure 1. Total number of accesses to the Moodle tools.

As we can see, in the sample that has been obtained, there are many different types of tools. So, it is necessary to establish an organization or classification of the same in categories to work with an adequate number of parameters. In response to the use of the tools, and to the indications that it facilitates the own platform Moodle, we performed a classification/ organization into four categories (*Storage*, *Collaboration*, *Communication* and *Assessment*) that are displayed, then, in the Table 1:

	Classification Tools Groups
Storage	Label, Resource, Upload
Collaboration	Forum, Glossary, Wiki, Workshop
Communication	Calendar, Chat, Journal
Assessment	Assignment, Choice, Lesson, Quiz, Survey

Table 1. Classification of the tools by tools groups.

Once established this classification/organization in tools groups, an analysis has been made by tools groups to learn about the average number of accesses for each student to the different groups that were used to teach the curriculum described of the reference center. This average number of accesses to each student by tools groups is reflected in the Figure 2.

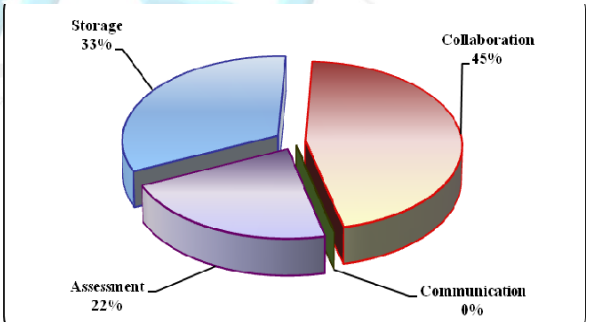

Figure 2. Average number of accesses by tools groups.

According to available data, the tools groups most commonly used are those of *Collaboration*, *Storage* and *Assessment* that correspond respectively with the tools *Forum*, *Resource* and *Assignment* which are most commonly used as can be seen in Figure 1. On the other hand, the *Calendar*, *Chat* and *Journal* tools, belonging to the group of *Communication* tools, they are hardly used. Conducted a statistical analysis of Chi-square with the sample data for the academic year 2010-2011, we find that all the groups of tools have variation. The tools group that is experiencing a higher variation in the average number of accesses per student and per tools group, is the group of *Collaboration* tools (Chi-square value 199.131).

If it also performs a statistical analysis of the dependence or independence between the different pairs of groups of tools during the period 2010-2011, it can be concluded that, all pairs of groups of tools have dependency between them. The

greater dependence is between the pair of *Storage* tools group with the *Assessment* tools group (value Chi-square 148.01). In contrast, the less dependence is given between the *Collaborative* tools group with the *Assessment* tools group (value Chi-square 35.08). After the analytical process we can see that dominate the access to the of *Collaboration* and *Storage* tools. Otherwise the access to *Assessment* tools group always involves an access to *Storage* tools group.

V. CONCLUSION

Facing the great amount of data that we collect from online learning the field of education is seen in the need to process all the information available to improve their benefits. The combination of Big Data with the learning analytics are a good tool for the processing of these data, which will enable us to guide the necessary reforms to adapt to the new educational circumstances, despite being two areas of recent introduction. From this study may be inferred a series of information that enables us to advise teachers to improve, both, the learning process and the teaching process. Note, that the most frequently used tools are the corresponding to *Collaboration* and *Storage* tools, which implies a large amount of data when they are handled by both the teachers and the students. These data must be intelligently organized to obtain their maximum performance and to get new improvements and optimization of learning methods. Likewise, it can be inferred from the use of *Assessment* tools the need for teachers to define new forms of evaluation to increase the accesses to these tools. Instruments such as the headings of evaluation can be an alternative for the improvement of this type of tools. Highlight, in addition, the need for this improvement due to the high dependence shown in the survey with respect to *Storage* tools. Lately, higher education is beginning to worry about how to improve its learning methods and about how to increase its quality, finding, in the data processing new technologies and the analytical methods, valid tools to achieve its aim.

VI. REFERENCES

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