Using Learning Analytics to Evaluate Students in Blended Learning System

Meriem Adraoui, Asmaâ Retbi, Mohammed Khalidi Idrissi and Samir Bennani

RIME TEAM-Networking, Modeling and e-Learning Team- LRIE Laboratory- Research in Computer Science and Education Laboratory- Mohammadia School of Engineers (EMI), Mohammed V University in Rabat_ Morocco
E-mail: meriemadraoui@research.emi.ac.ma, retbi@emi.ac.ma, khalidi@emi.ac.ma, sbennani@emi.ac.ma

Abstract: Although e-learning is increasingly used in higher education, but some students find it difficult to adapt because they need direct interactions with the instructors. On the contrary, traditional course always keeps the face-to-face communication. Therefore Blended learning system offers the best of both worlds; it improves student participation, engagement, and preparation. In this paper, we will explain how learning analytics can be used in educational institutions to monitor and predict student's performance.

Keywords: learning analytics, blended learning, blended learning models, blended learning analytics.

I. INTRODUCTION

A new phenomenon termed online learning (E-learning), emerged in October 1999, during a CBT (computer-based training) Systems seminar in Los Angeles, and apparently, it changed the way many faculties teach and students learn. In addition, for most institutions, online technology is being integrated with face-to-face instruction in what is commonly being referred to as blended learning [1].

Blended learning, originally referred to adding an online component to the classroom education. It can be used to support face-to-face teaching, large group and small group learning, self-directed learning, communication between the instructor and individual students or groups of students, as well as between students themselves. In higher education, Blended learning is being utilized with increasing regularity and it allows teachers to use their time more effectively.

Blended Learning has different surfaces which they are difficult to define because they require contents adapted to this mode of learning, and they combine face-to-face education and online technology. The challenge is to define students' interest and which data are significant for them. Every student generates a unique data trail, learning analytics is the process of using this data to help LMS (Learning

management system) users (students, instructors, administrators, decision makers) to improve learning outcomes [2].

Learning analytics is considered to be a fundamental element of analysis in the different online distance learning environments. Khalil and Ebner listed the primary benefits of applying learning analytics in MOOCs as the following: predictions, recommendation, Visualization, Entertainment, Benchmarking, Personalization, Enhance Engagement, Communication Information, and Cost Saving [3]. Also in serious games, the use of learning analytics is recommended to assess the engagement of players during the game and to make sure that a serious game reaches the goal which was set by the instructor [4].

Learning analytics can be done by using the social network analysis (SNA) methods to understand the interactions between students [5], and it can also be applied to sentiment analysis to predict the model for reflecting the common interest through passing the comments and feedbacks of the learners [6].

In blended learning system, learning analytics implemented in different ways and for a variety of reasons, it can be used to identify students' status (at risk, normal, ahead) based on their activity in a course, to improve students' retention and success, to detect learning difficulties and it can also help instructors to monitor students in real time. Learning analytics is seen by some universities as a way of enhancing teaching, it gives instructors some information about the quality of content and activities they are providing [7].

In this context, this paper examines the use of learning analytics in the blended learning system. In detail, the paper is organized as follows:

In the first section, we will provide a basic introduction to blended learning systems and the models that currently exist. In the second section, we will define learning analytics and we will give examples of institutions that have made use of learning analytics to improve students' success and retention. In the last section, we will discuss the examination of learning analytics in the blended learning system. Finally, we will draw some conclusions and present new lines of future work.

II. BLENDED LEARNING SYSTEM

3.1. Definition

Blended Learning is a hybrid learning system that combines the characteristic of traditional studies with the benefits of online learning to offer a personalized education knowing that the face-to-face training dedicated to the essential points. It then becomes much more efficient, motivating and it gives much better results [8].

The word "blended" implies a mixture rather than simply an attaching of components. When a picture is added above a text, a presentation is created and the paragraph may be more informative to the reader, but the text and the picture stay intact and can be individually detected. Then again, when two cans of different colored paints are mixed, the new paint will look different from either of the original colors. In fact, the original colors won't exist if the new paint is mixed well. Similar situations exist in blended learning [9]. The mixture can be a simple separation of a part of a face-to-face course into an online component (Video, text …).

The current definitions and taxonomy of blended learning include a broad spectrum both in the delivery modalities between offline and online and the pedagogies between instructor-led and student-

centered approaches. Four possible combinations have co-existed so far in the representative 4 types including:

1) Mostly face-to-face class with substantial online activities.
2) Mostly online class with student offline group meeting.
3) Mostly face-to-face lecture with online resources.
4) Mostly online lecture with optional face-to- face meeting [10].

Blended learning combines different types of education techniques and technologies. In online portion, Blended learning benefitted from using both synchronous and asynchronous delivery modes to improve student's engagement. In synchronous learning, the instructor leads the program when all participants are logged in at the same time and communicate directly with each other such as video conferencing and chat. Synchronous learning sessions help online learners to feel like participants rather than isolated by asking and answering questions in real time. In contrast, asynchronous learning allows students to interact directly with the content via technology system at any time, for example, Q&A mentoring, Asynchronous online discussion (AOD) and email [11].

2.1. Blended learning models

Many schools have implemented more than one blended learning model for their students. A model represents a particular program within a school, it can combine different online learning to create a blended learning knowledge for students [12] [13].

2.2.1. Rotate model

The rotation model is one of the most common models in blended learning, it contains four different models: Station rotation, lab rotation, flipped classroom, and individual rotation.

Station model

In station rotation model, students rotate on a fixed schedule set by the teacher and they rotate through throughout station. The rotation includes at least one online learning station. They start with teacher-led instruction, then they move to collaborative activities such as small group, group project, individual tutoring and pencil-and-paper assignments and they move once again to work on the computers and online learning[12].

Lab model

In a lab rotation model, students follow a fixed schedule, they rotate between a classroom and a computer lab, in which students learn primarily online, the classroom is generally reserved for other learning activities. This model differs from the station-rotation model because student do not stay in one classroom but they rotate among many locations on the campus [12].

Flipped model

This type of blended learning allows students to choose the location where and the time when they receive content and instruction online. Basically, what has been done traditionally in a classroom is now done at home, and what has been done traditionally for homework is now done in the classroom [12].

Individual rotation

Individual Rotation model allows students to rotate on an individually customized and fixed schedule, instructors assign each student a specific schedule. This model differs from the other rotation models because students follow their own program and they do not need to rotate all stations[12].

2.2.2. Flex model

In the flex model, the content and instruction of program are delivered online, students move flexibly through different learning modalities to optimize their learning experience based on their specific needs. Learning is primarily self-guided, students' work independently in their own place using online course and teachers can examine real-time data to identify at-risk students [12].

2.2.3. Self-blend model

In Self-blend model, students choose to take one or more courses offered remotely to supplement their traditional course. This model of blended learning is ideal for the student who wants to take additional Advanced Placement courses. Therefore to be successful in this model, students must be highly self-motivated [12].

2.2. Blended learning model use cases in Morocco's universities

In Moroccan universities, the use of blended learning is becoming popular, for example, teaching French in class for just an hour and a half per week is not enough to cover all elements of linguistic and communication skills (oral and written understanding and expression). So, they use the platform for preparing the French language online. The student is therefore led to express himself orally during simulation activities (dialogues, role game) in class. Individual activities of writing or of systematization of the structures of language (grammar exercises) are going to be developed through online course [14].

In this context, we proposed the different use cases of blended learning model in Moroccan Higher education based on student's needs and institution's resources and the benefits of each model.

2.3. Blended Learning Analytics in higher education

In Blended learning world, the data are created by online learners in online sessions, for each online transaction they produce data, while they are taking a course or a training module. It is in our hands to make profitable and effective use of these data to provide useful and significant insights into learning and teaching, which is especially helpful for the blended learning environment.

To analyze the data generated by learners, learning analytics is the process of examining this large amount of data for the objective to generate the report used to uncover useful information. It allows users to personalize the way to learn, modes and contents of the blended learning training. The objective is to improve the rhythm of the learners and to propose the contents the most adapted to their current skill level and with this mode of learning.

Among the strategies to be considered in the academic programs of blended learning is the effective use of learning analytics with the regard to the profile of learners and to follow their performance with the aim to:

Table 1
Blended learning models use cases and benefits

Blended learning model	Use cases	Benefits
Station Rotation	Large class sizes.	Work with smaller groups of students. Uses stations to direct students through different modalities.
Lab Rotation	Students who need to move at a slower pace. A well-equipped computer lab and WIFI connection.	Using learning lab depending on student's need.
Flipped Rotation	Students who struggle to do homework on their own.	Students can watch lectures on-demand at home and can repeat it if they need to review it again.
Individual Rotation	When every student has different needs, different Learning Styles, …	Students rotate on an individually customized schedule.
Flex model	When the majority of students identified at risk.	Flex model gives students more independence than others, and they can receive help from instructors when needed.
Self-blend	Ideal for self-motivated learners.	Self-blend model gives students the freedom to supplement what they have learned.

- Identify at-risk learners.
- Control the learners in real-time.
- Develop strategies for support and assistance
- To Reduce Abandon Rates

III. LEARNING ANALYTICS

3.2. Definition

The definition of Learning analytics set out in the call for papers of the first international Conference on learning Analytics and Knowledge (LAK 2011) and adopted by the Society for Learning Analytics Research (SoLAR): "*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*" [15].

Learning Analytics collects the digital tracks left by the learners, exploits them to improve learning, and to create relevant learning experiences during the delivery of a course. *Learning analytics is the use of intelligent data, learner-produced data, and analysis models to discover information and social connections, and to predict and advise on learning* (Siemens, 2010) [16].

3.3. Types of Data Available for Learning Analytics

The tracks of the learners in the online portion of blended learning system generate a vast quantity of the data which educational establishments can use to supply teachers with the useful information to improve student's performance and to increase retention.

Learning Management System (LMS) generates reports known as "log files" that includes the basic details, which can be used to personalize content and to create a successful learning path for each student such as:

LMS visit frequency: these data provide information about how students participate in LMS activities to identify the most active learners.

A number of Times Resource Accessed: This information helps to select what course that person hasn't taken to identify the most visited courses.

Types of Resource Accessed: There are various types of learning resources (wikis, texts, videos, pictures …), this information helps to choose the most consulted resource's type.

Date and Time of Access: It gives information about the time and the date a user has accessed to a course. It will show who aren't finishing their course.

Participation Report: This type of report gives details on the learners who have participated in the online discussion.

A number of Discussion Posts Read: This information gives details about the most read posts, particularly to identify unread posts and to know why they are not read; for example, the size of a post is very long or the content is not clear.

3.4. Learning analytics (Case Studies)

There are many institutions that have made use of learning analytics to improve students' learning.

1) Rio Salado Community College's Progress and Course Engagement (PACE) system.

PACE or Progress and Course Engagement is a system for automated tracking of student progress. Rio Salado College's has implemented this system for non-traditional students to achieve their educational goals through programs and services tailored to individual needs [17].

The college has developed learning analytics to their system, specifically to provide early interventions that can help to try to find the reasons those students are struggling for and to determine ways to help them.

To develop PACE, Michael Cottam, an associate dean for instructional design at Rio Salado indicates that there are three main predictors of success:

• The frequency of a student logging into a course.

• Site engagement. (Engagement with the course materials online and the practice of exercises).

• How many points they are getting on their assignments.

The combination of these three factors acted as predictors of success and the reports that were generated show green, yellow, and red flags, to identify the level of risk for every student in a course, which helps the instructor on quickly serving the ones who are most at risk.

2) Northern Arizona University's Grade Performance System (GPS).

Grade Performance System (GPS) is Northern Arizona University's system warning alert, for increasing instructor feedback and facilitating instructor-student interactions. GPS also creates an entire network of information for students, instructors, and university personnel [18].

The instructor can access the GPS interface and select automated comments of general concern for presence and grade with a click of a checkbox. As well they can comment on students' grades, academic concerns, and positive feedback.

Or students receive alerts regarding grades, attendance and feedback instructor and they have a number of options to use depending upon the nature of the alert.

An instructor's feedback is available to the individual student and also to university personnel to make a support network for all students.

3) Purdue University's Course Signals System.

Course Signals has been employed at Purdue University since 2007, is a warning notification system using for each beginning cohort at the institution, to determine in real-time which students might be at risk, partially indicated by their effort within a course [19].

Student Success Algorithm (SSA) is run to predict at-risk student in this system, it has four components:

- **Performance**: this percentage related to students' grades in the course.

- **Effort**: students' effort measured by tracking the number of interaction with Blackboard Vista.

- **Academic history** is about the academic history the student, such as average grade, course loads, grade repetition…

- **Student characteristics**: such as age, gender, prior knowledge, residency…

IV. DISCUSSION

We divided our work into two main parts: the first reviews the definition and the models of blended learning system and the second presents learning analytics process and some institutional use cases. The question we should be asking is: how can we evaluate a student in blended learning system using learning analytics? First of all, we need to choose the best-blended learning model based on student's needs and institution's resources. After that, we can develop an LMS platform choosing some specials activities. The next step is the collection of the log data that includes the basics information about student's traces.

Based on log data, learning analytics process could help instructors to use effective strategies to discover factors relating to students' success, this strategy can be used to encourage them to change their behaviors [7].

To measure growth students' achievement, we can employ some classification algorithms to improve the instructions of online transactions by reinforcing positive educational practices and discouraging negative ones. A positive signal encourages an institution to follow the current instructional plans. Contrariwise, a negative signal seems as a departure point of change the strategies of teaching and learning.

V. CONCLUSION

In this paper, we have discussed the benefits of using learning analytics in blended learning system to identify successful learners. Learning analytics has the potential to change the way of learning and teaching, and to provide students with new information to make their choices about their education.

Learning analytics process has a great importance in education, as we have mentioned, there are many institutions such as Purdue University, Rio Salado Community College, and University of Northern Arizona are demonstrating the vast benefits of learning analytics for students and faculty; it can use to solve many educational problems, it was helpful to inform higher education administrators about the exact role that they can play, to inform teachers about their students, and to inform students themselves.

In Blended learning system, learning analytics offers many options depend on the institution's needs, each institution must think about which approach they want to use, such as:

✓ Which learning activities can be used in an online learning environment?

✓ Which parts of the assessment can be done in the online learning environment?

This study has limitations that should be addressed in future research. The prediction of student performance in online activities needs to be visualized in graphs. The visualizations can be presented to LMS users, to inform them about their real-time status. Moreover, after identifying at-risk students we need to recommender certain learning resources to help them, for this, we provide to integrate a recommender system for users to help them to make an easy navigation in an LMS platform.

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