# APPLICATION OF LEARNING ANALYTICS TECHNIQUES ON BLENDED LEARNING ENVIRONMENTS FOR UNIVERSITY STUDENTS

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## Motivation of the work

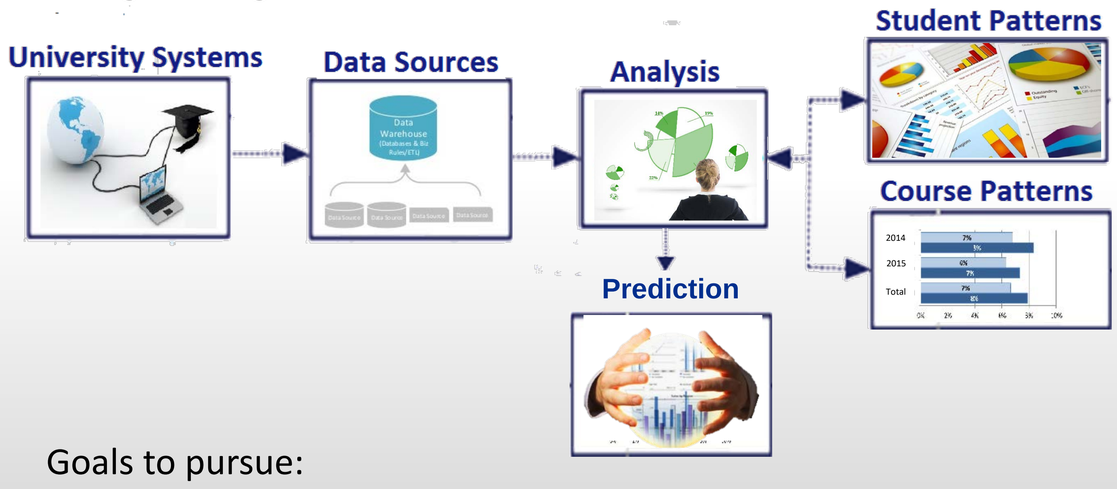
The emergence of E-Learning platforms is changing not only distance education but also face-to-face education. One of the biggest challenges when talking about educational platforms is the testing and dissemination of knowledge.

Unfortunately, these platforms do not provide specific tools to allow educators to thoroughly track and assess all learners' activities while evaluating the structure and contents of the course and its effectiveness in the learning process [1].

Currently, it is innovating the learning process with various techniques, but has not been able to measure the degree of learning acquisition.

## Objectives

The main objective of this thesis is the research and application of learning analytics techniques for prediction and prevention of failure and dropout of students at university level under the blended-learning training model.




Goals to pursue:

- Analyze the relationship between the frequency of interaction and the acquisition of knowledge reflected in the academic performance of students.
- Detect behavioral patterns of students and design patterns of courses.
- Infer the student's grade based on their interaction with the e-Learning platform.
- Propose a classification of students based on their interaction, behavior and performance.
- Recommendations of design for academic courses

## Research Plan

The research has two stages: the first one is the collection and processing of data and the second one is the application of learning analytics techniques.

**First Year**

- ☑ Analyze the state of the art in learning analytics.
- ☑ Literature review and knowledge about the environment (Learning Analytics, E-Learning, Educational Data Mining, Learning Process, etc.).
- ☑ Exploratory analysis of the data obtained from the E-Learning platform.
- ☑ Use "classic" statistical techniques (clustering, time series, etc...) to study the relationships between students' behavior on the platform with their final grade.
- ☑ Analyze learning analytics techniques to select the best option. Implement a classification algorithm of students based on the interaction of students with e-learning platforms.

**Second Year**

- ☑ Apply an experimental methodology that combines learning analytics techniques in the field of data analysis (linear regression, clustering and classification techniques) with technological contributions.
- ☑ Improve the classification algorithm of students and subjects in order to predict final grades of students based on their interaction with the platform.
- ☑ Propose a new taxonomy to classify students based on two types of interaction (content and social interaction)
- ☑ Detect the different types of students by applying clustering methods to improve the design of continuous assessment.

**Next Year Planning**

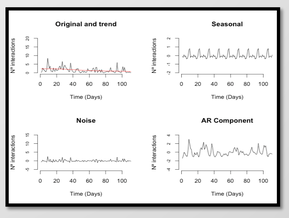
**Third Year**

- ☐ Validate the previous tecniques with real data from the platform faiTIC of the University of Vigo. [55%]
- ☐ Develop plugins for the e-learning platform to put into practice the studies and algorithms developed.
- ☐ Thesis paper preparation and dissemination of global results in prestigious international forums in the field. [25%]

## Preliminary Results

Clasification by final grade

Based on times series. The analysis shows different profiles of interactions student-platform and correlation with grades. [2].




We proposed a new taxonomy (classification) based on types of interaction (content and social), which was based on Bento's taxonomy. [3]

| Social | Quadrant III HII LCI | Quadrant VIII HII MCI | Quadrant IV HII HCI |
|---|---|---|---|
| | Quadrant VI MII LCI | Quadrant V MII MCI | Quadrant IX MII HCI |
| | Quadrant I LII LCI | Quadrant VII LII MCI | Quadrant II LII HCI |
| with Content | | | |

Clasification by type of interaction

After classifying, we predict the final grade with a Multiple Linear Method at three control points (8th week, 12th week and 14th week). We get the following absolute errors. [4]

Prediction of final grade

| Quadrant | 8th week | | 12th week | | 14th week | |
|---|---|---|---|---|---|---|
| | 1° approach | 2° approach | 1° approach | 2° approach | 1° approach | 2° approach |
| Quadrant I | 1,43 | 1,32 | 1,49 | 1,46 | 1,14 | 1,35 |
| Quadrant II | 0,72 | 0,57 | 2,31 | 2,00 | 1,39 | 1,12 |
| Quadrant III | 1,75 | 1,58 | 1,54 | 1,75 | 2,15 | 1,48 |
| Quadrant IV | 1,56 | 1,58 | 1,68 | 1,48 | 1,54 | 1,59 |
| Quadrant V | 1,47 | 1,42 | 1,61 | 1,34 | 1,39 | 1,54 |
| average | 1,39 | 1,29 | 1,73 | 1,61 | 1,52 | 1,41 |

## References

[1] M. E. Zorrilla, E. Menasalvas, D. Marin, E. Mora, and J. Segovia, Web usage mining project for improving web-based learning sites, In Web Mining Workshop (2005), 1–22.
[2] C. González, S. Sánchez, R. Díaz, A. Fernández, " Will I pass the course? performance analysis based on time series " (CIINDET 2016).
[3] S. Sánchez López, R. Díaz Redondo, A. Fernández Vilas, " Is social participation necessary to pass an academic year? ", (TEEM 2016).
[4] S. Sánchez López, R. Díaz Redondo, A. Fernández Vilas. "Predicting students' grade based on students behavior" (under review International Journal of Engineering Education (IJEE))