Learning Analytics

The learning behavior of students is examined based on their digital interactions tracked in the logbook of the Learning Management System Moodle. The data is processed by an algorithm and displayed in an interactive dashboard supporting lecturer decision-making. Furthermore, predictions of the students' final grades based on the logbook are computed.

Introduction and Objectives

The BFH uses the learning management system Moodle. This serves as interface between lecturers and students and is used to provide course material and other didactical activities. Currently, there is little and unstructured knowledge about the respective usage of course contents. Insights into the different approaches to how course content is used could lead to measures for a better learning environment.

The Moodle logbook, where all interactions between users and the Moodle platform are stored, forms the basis for this work. The goal is, first, to gain knowledge about the behavior of users in relation to the learning content. And second, to make it easy for lecturers to draw conclusions about the behavior of students, their engagement, and performance, using a dashboard.

Research Design

This thesis focuses on three aspects: (1) hypothesis testing, (2) grade prediction, and (3) decision-support via a dashboard. For this purpose, data consisting of 181'000 logbook entries, were used.

The data analysis is done with python, which is used to clean and expand the logbook data. Linear OLS Regression is applied to test hypotheses based on metadata such as access time, type, and number. This data is further processed in a random forest model (prediction) and is also used by the dashboard.

The dashboard is created using Microsoft PowerBi. Through discussions in the project team as well as interviews with potential users, the most useful dashboard content were defined.

Results

Hypothesis testing revealed that the number, type, and timing of interactions in the Moodle course were related to the students' final grades. A weighting system regarding the relevance of the logbook entries could be developed. With an r-squared of 47.4%, the multiple regression with the weighted variables "time" and "type" was strongest. These findings were used to develop a random forest model which can predict students' grades with a standard deviation of 7.2 grade points based on the logbook data of a course.

In addition, the dashboard created can automatically import, cleanse, expand, predict, and visually display the logbook data and can be parameterized individually. The visual representations allow lecturers to access the processed logbook data. In addition, two tabs were created, one for individual student analysis and one for general course behavior analysis.

Implications and Recommendations

This thesis formulates an approach of operating logbook data from the Moodle platform. The following approaches would be conceivable for future work.

Data extension: Currently, it is not possible to integrate the study schedule into the Moodle platform, but this data expansion would reveal the importance of class participation, preparation and follow-up of class material.

Data volume: Larger sample analysis can lead to other data handling methods. Currently, students are compared to their peers within the same course. Further approaches could compare students with themselves across multiple courses or throughout their studies.

Student involvement: Another approach would be to provide the dashboard to students. This follows the principle of „help for self-help" and enables the students to solve their problem situations independently.
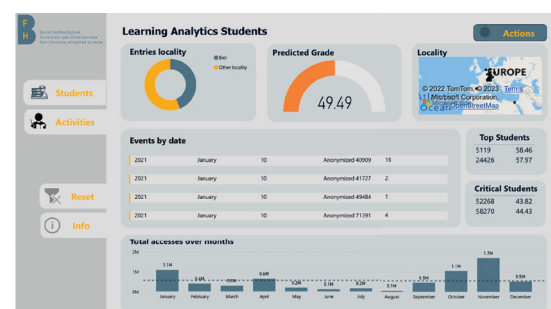
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Figure 1: Graphical User Interface developed with PowerBi