GLA: A Generic Analytics Tool for e-Learning

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Abstract: Several software applications are used at the University of Mannheim for learning and teaching purposes. The majority of them, like lecture feedback, quizzes, forums, and wikis, are hosted within our learning management system ILIAS. In addition, we run several prototypes of serious games and mobile feedback systems. While the data generated by students and teachers is mainly used for current courses, it could be further used for *Learning Analytics* if it was stored in an adequate format. Considering the variable and fast-moving nature of our learning applications, we invented a concept for a generic database structure, that can handle analyses on a variety of original tools. This paper presents the prototype application *GLA* (*Generic Learning Analytics*), which tries to provide a step in the right direction. Data from wikis, forums, quizzes and serious games transformed into one homogeneous format that can be used to do comparable analyzes. Beside comparing several semesters and courses of one application, we can also match related data sets e. g. user behavior between a wiki and a file upload.

1 Introduction

At the University of Mannheim, students commonly use the learning platform ILIAS to download files or participate in a wiki. They can post questions as well as give and find answers in a forum, while teachers use the platform for knowledge benchmarks with tests or quizzes. But until today, none of the available data was used after the grading process. This marks the starting point for *learning analytics*. Our goal is to further use the data produced by tools like our *MobileQuiz* [SKE12] and *Word-Dpmonation* [MCE14] to get information about the learning development of students over the semesters and do analysis across these different applications.

This paper introduces the *generic learning analytic (GLA)* tool which helps all participants to better use the educational data. With this, lecturers and faculty members can evaluate the learning success and teaching methods more accurately and improve the learning scenarios for the students.

2 Related Work

Considering the term learning analytics, the following definition is used by Siemens et al. [SB12] and comes from the international *Learning Analytics and Knowledge Conference* in 2011: *"Learning analytics is the measurement, collecting, analysis, and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs."*

Several tools have been developed to support learning analytics, such as *eLAT*[DZB12] which was presented by Dyckhoff et al. in 2012. It is an exploratory Learning Analytics Toolkit, which allows lecturers to correlate learning objects usage and user behavior. One of its main goals is to process the data within microseconds and thus allow individual data analysis for teachers to help them to self-reflect their technology-enhanced teaching and learning scenarios. *eLAT* already has a connection to four Virtual Learning Environments (VLEs), but like *LeMo*, it offers a fixed set of analyses and has to be extended for adding additional ones.

3 The Generic Learning Analytics Tool

The *generic learning analytics* tool (GLA) tries to analyze all data that are recorded by learning applications at a university setting. The core piece of this tool is the data schema which is as generic as possible, so new kinds of data from different types can easily be integrated.

3.1 Database Schema

The *generic learning analytics* tool takes its name from the generic database schema as shown in figure 1. It is built hierarchically and is designed to store a large variety of data. The highest level object is *lectures*, which is related to the *semesters* table. Beneath the *lectures* are the specific *classes* which represent a single lecture unit. The *modules*, *modulespecifications* and *useractions* -tables store the interesting data for the analyses. The *modules*-table is the most generic table, it stores the different content types. The current tool version supports five different module types: Quiz, Forum, Files, Wikipedia, and Survey. An important element of the module table is the *Mo_Parent* column. This column enables the user to define interdependencies between different modules. It can represent a simple Quiz or a whole tree structure which is used in a forum. Figure 1 shows that the *module* is referenced by itself. The *modulespecifications* table represents one specific file, question, or post of a forum that belongs to exactly one module. The actual logged data from the virtual learning environments are stored in the *useractions* table. The column *UA_Text* can represent an answer of a quiz whereas the *correct_value* can specify this answer as right or wrong. The *actiontype* field is used to store if the action pushed data into the system, e.g. by a file upload, or if a user get data out of the system,
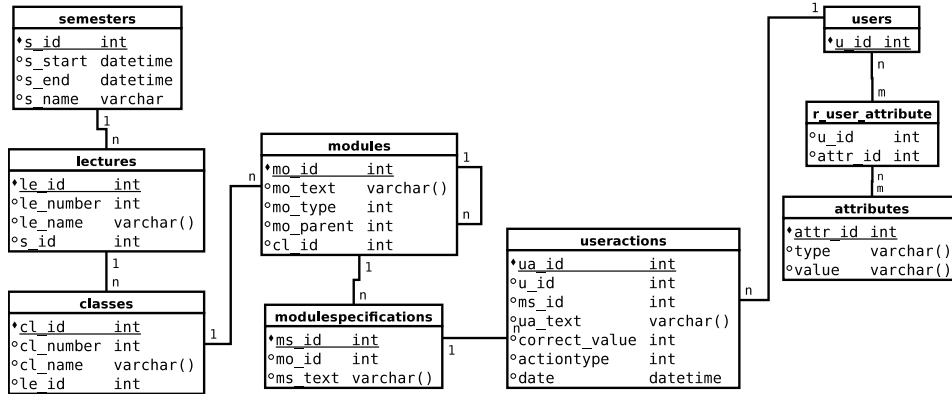
Figure 1: The database relations of the generic learning analytics tool.

e.g. by a file download. This field, in combination with the time stamp saved in the *Date* column, is used for analyzing the *Adoption Rate* or the *Time of Quiz Answers*. Every action is linked to exactly one user. Every one can have a set of attributes attached to him via the *r_user_attribute* relation. The table matches the attributes from the *attributes* table to the users in the *user* table. Since the gender is the only attribute that is included in the *attributes* table at the moment, every user is anonymized. However, this can be further expanded in order to conduct different analysis like the performance of different course of studies within one lecture.

3.2 System Features

The tool has four main areas organized in different tabs. The *update database* tab offers users a short overview of the data schema and the data that has already been imported into the database, while the other three tabs bring the user to the analysis on different levels of granularity. These tabs include the *lecture-analysis*, the *class-session-analysis*, and the *user-analysis* areas. In the *lecture-analysis area*, users have the ability to compare the overall performance of one lecture in one semester to the performance of other semesters. The analysis that can be made with the *class-session-analysis area* are similar to the *lecture analysis area* with the exception in terms of the level of granularity. Here, instructors can compare two almost identical classes they held in different semesters. The *user analysis area* is an additional area that should provide more direct help for the students. The *activity area* view allows the user to compare one single user to the rest of the course participants. In practice, it could be used by a student to compare his activity areas with his peers in order to see in which area he might be able to increase his learning process. The second analysis is the *attributes' difference* view where the user can compare the performance of two groups who differ in some attribute to each other. The analyses can further be divided into *usage* and *content*.

Usage: Usage describes the access and the activity within the features. With this function, instructors can get a good overview at what time of the semester (or week or day) the students are more engaged with the virtual learning environments and when they commonly lack engagement. With this information, they may be able to adjust the extrinsic motivation for using some of the features.

Content: Beside the simple activity, some features should be analyzed with the provided content. Especially quizzes and tests, which can easily be separated in good (e.g., right answers) and weak (e.g., incorrect answers) content, should be analyzed this way. The percentage of correct answers of each question in each quiz is computed and displayed within this view.

4   Conclusion and Future Work

The *generic learning analytics* tool proposed in this paper can be a first step towards establishing *generic learning analytics* at the university level. The prototype gives the university a good starting position to evaluate the power of learning analytics within their already established virtual learning environment. Right now, it focuses on the evaluation of the students' interaction with the virtual learning environment and supports analysis functionality for the teachers.

Future work will contain the connection to more data sources and further content types as well as a additional pedagogical evaluation.

References

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