ABSTRACT
The primary goal of the LeMo tool is to support teachers, content providers and researchers in analyzing trends in usage data stored by learning systems. LeMo operates on data obtained from learning management systems like 'Clix' and 'Moodle' as well as on data from generally accessible learning portals, like the free encyclopedia 'ChemgaPedia'. The LeMo prototype offers several analyses: usage in time, frequent learning paths, an activity-graph, and test performances, for example. Various filter settings regarding time, learning-object type, user group, and visual settings allow more specific investigations. The focus of LeMo lies in its usability and dynamic visualization.
1. THE LEMO-PROJECT
So far in Germany analyzing learning data remains an interest of a small community of experts, since the available tools are not easy to use and not compatible with the various learning systems eLearning-professionals usually have to deal with. To develop a prototype of an application that enables teachers, content-providers and researchers to conduct analyses on learning data themselves to profit by ‘Learning Analytics’ is the purpose of the project ‘LeMo’.

To address the various needs of these three target groups, LeMo enables analyses on different kinds of learning systems such as learning management systems (LMS) and learning portals. LMS require a login to personalize the accessible content and are used by most universities. Learning portals are generally accessible and used by free encyclopedias.

We considered also the aim to support teachers who work with a variety of didactic methods and amounts of technology support, i.e. eLearning as a supplement to lessons at university, blended learning and distance learning via eLearning.

To detail the requirements for learning analyses we conducted a survey addressed to stakeholders of the three target groups. As a result we acquired a catalogue of approximately 80 questions and assumptions regarding students learning behavior and use of media. Based on the catalogue of questions we derived twenty-seven analyses that provide indicators to help answering the referred questions.

2. THE PROTOTYPE
We started the implementation with the most required analyses according to the number of questions answered by their results. Implemented analyses are, for example, ‘Activities/Time’, ‘Activities/Learning-Objects’, ‘Frequent Paths’, ‘Activity-Graph’ and ‘Accumulated Activities/Weekday’.

Each analysis can be modified by several filter settings to conduct more specific investigations. Filters refer to the time period of interest, the chosen types of the learning-objects such as forum, quiz, question, resource, wiki, group of users or specific settings to influence the respecting visualization. Visualizations adapt to new settings dynamically and support the usability as well as the users’ reception of the data.

LeMo is realized as a three-tier architecture, with a data tier, a data-mining tier and a presentation tier. LeMo provides a unified data model, which contains the most used entities existing in different LMSs. The prototype contains connectors to the LMSs ‘Moodle’, ‘Clix’ and the free encyclopedia ‘Chemgapedia’. For an easy adaption to new learning systems, the LeMo connectors can be replaced by a standard connectivity.

The LeMo-tool will be published open source in June 2013.

3. THE INTERFACE
The user interface follows an explorative metaphor ‘Overview first, filter and details on demand’. Herewith we try to assist the analysis of learning data in an investigational way.

After logging in on the LeMo-homepage, the user faces a dashboard. Each widget on the dashboard represents a selected course with its basic data and a line graph of accumulated activities in a recent time period. This first overview can give indications for expected and non-expected user behavior regarding the teachers’ intentions.

The teacher can chose one of the widgets or go to the “My courses”-page to get more information and conduct more analyses on a certain course.

On the right top corner of the page general settings such as the user name, the language and the password can be modified.

4. ANALYSES AND VISUALIZATION
As follows certain analyses will be presented selected by the variety of their visualizations.

4.1 Activities/Time
The most required analysis was the overall number of activities on the courses learning-objects over the course of time. This analysis is visualized by a diagram, which shows the line graph of the number of activities and the line graph that represents the number of students who caused these activities. Hovering the cursor over the line will evoke a tool tip that shows the exact number and point in time.

To allow both, the overview on a selected time period and the focus on detail, the user can pick out a certain time slot from the lower diagram to get an amplified view in the main diagram above. The user can deactivate and activate the line graph of the activities as well as the line graph of users to achieve more clarity. This is very helpful to compare line graphs of two or more courses that are represented in the same diagram.

Below the diagrams all learning-objects of the course are listed in a table. The columns show their learning-object type, title and number of requests. Each column can be assorted alphanumerically by click on the title. That allows for example to show the most used and least used learning-objects.
Filter settings determine the considered time period and reduce the analyzed data to certain learning-object types or selected users. If no filter is set, all data is considered. These Filters remain the same at all analyses.

4.2 Activities/Learning-Object
This analysis represents the number of activities concerning each learning-object assorted by number in order to compare them among all learning-objects in the course. Furthermore the number of students who produced the activities is shown.

4.3 Activity-Graph
The analysis’ results are represented by a visualization of a navigation network, which users have characterized by the sum of their individual navigation steps.

4.4 Frequent Paths
Reviewing the most frequent sub-paths gives the teacher the opportunity to find out, if his students have accessed the learning-objects in the intended order.

The number of different user paths containing the sequence is called ‘absolute support’. ‘Relative support’ is the percentage of user paths containing the sequence. A sub-path is called frequent, when its relative support exceeds a given minimum support threshold. The algorithm, we are currently using to identify frequent sequences in the usage data, is called BIDE [1].

4.5 Accumulated Activities/Weekday
The accumulated average activities on each day of the week are represented by the usual Box plot values and visualization.

5. Accumulated Activities

5. EXPECTED INTERACTIONS
The LeMo-application will be presented with a short introduction to the projects’ aims. Analyses will be described and conducted during the presentation. Filters will be modified in order to show the visualizations’ adaptation. Questions answered by these analyses will be discussed with the audience.

6. REFERENCES