

Visual Exploration of Interactions and Performance with LeMo

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ABSTRACT

The demo will show how the LeMo (**L**ernprozess**M**onitoring) tool supports teachers to explore visually how students interact with learning resources and how they perform. The information obtained in this visual exploration guides subsequent more involved analyses.

Keywords

Learning Management System, Visualization, Interaction, Performance, Visual Analytics.

1. INTRODUCTION

The use of a Learning Management System (LMS) to support teaching and learning is widespread. The usage data such systems store is not analyzed in a *routine basis* by different stakeholders to retrieve pedagogical information that could support reflection. For example, if a teacher notices that some non-compulsory exercise she has made available in her course is hardly attempted, she might do some further analysis: does it seem to have a positive impact on the mark of the final exam for the few students who solved it? If not, she might consider deleting it from the course for the next semester; if yes, she might change her teaching style so that more students attempt it.

The aim of LeMo is to support different stakeholders in their analysis of usage data stored by LMS or learning portals [1]. All what is needed is a module that exports the data stored by the LMS into the data model of LeMo. Presently 3 export modules exist for the LMS Moodle and Clix and for the learning portal ChemgaPedia. The current prototype focuses on teachers as stakeholders. It aims at supporting them to explore whether and how their students interact and succeed with the resources they have made available online. In order for teachers to grasp at a glance what happens and so to ease the integration of such a tool in their practice, exploration is primarily carried out through various interactive visualizations that follow the “overview, zoom and filter” principle [2]. A few visualizations are presented below. Attendees at the conference will have the opportunity to try out the tool by themselves.

2. VISUALIZING INTERACTIONS

The aim of Figure 1 and 2 is to help answering questions such as: do students access them, when, in which order?.

Figure 1 shows accesses on all resources of a course over time. The upper line gives the total number of accesses, while the lower line gives the number of distinct students. The diagram is interactive. Placing the cursor over the line will produce a tooltip that shows the exact number and point in time. To allow both the overview of 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 any line to concentrate on only one if needed. Below the diagrams all learning-objects of the course are listed in a table. The columns show the type of the learning-object, title and the number of accesses for it. Each column can be sorted by clicking on the title. This enables for example to view the most-accessed and least-accessed learning-objects. Filters allow for selecting particular subsets of the data. A filter allows for choosing another time period. A second one filters students, and a third one filters learning objects according to their type. A type can be ‘forum’, ‘assignment’, ‘wiki’, ‘file’ a generic term to design objects such as slides, and so on.

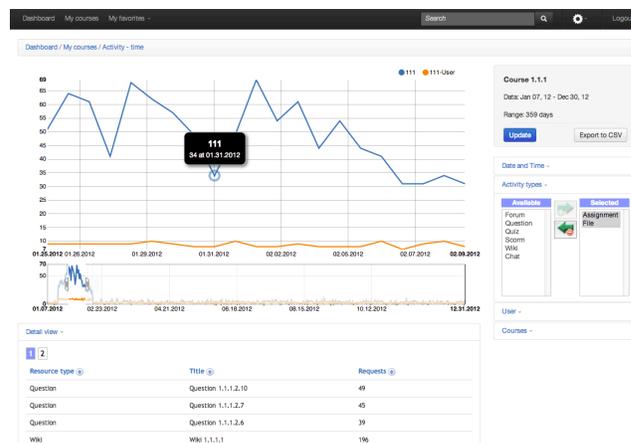


Figure 1. Access to learning objects.

Figure 1 shows this filter with the types assignment and file selected. All available visualizations have these three filters. Figure 2 shows the network of learning objects that results when order of access or navigation is taken into account. Learning objects are nodes colored according to their type. The size of a node is proportional to the number of accesses. Navigational steps between learning-objects are depicted by edges. The edges are weighted and color-coded to encode the amount of navigational steps. Placing the cursor over a node will bring up a tool-tip that includes information concerning the learning-object's name, the type as well as the total number of accesses or requests for it. For further exploration, a single click on a specific node will rearrange the graph in a way that it focuses on the node of interest, displaying neighboring nodes in the immediate proximity, and moves other nodes further away.

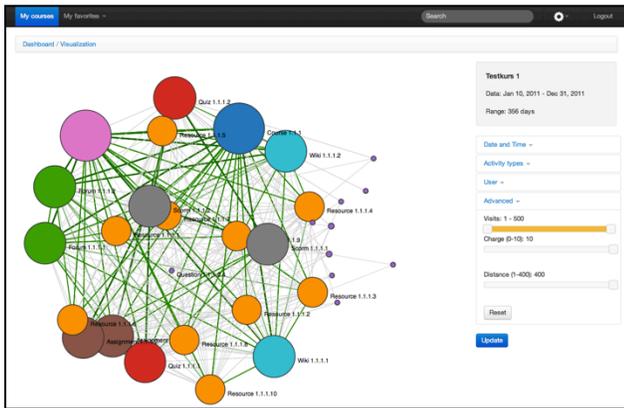


Figure 2. Network of learning objects according to navigation.

3. VISUALIZING PERFORMANCE

An assignment is a generic term meaning any work that can be graded, such as questions, exercises, tests, exams and so on. Most of the LMS allows for calculating easily useful statistics such as average and standard deviation for a given assignment. It is more difficult to visualize and compare performance of students across several or all assignments, a question raised by teachers. The visualizations presented here cater for this need. It is not rare that different assignments are marked differently. For example assignment 1 may be out of 20 points and assignment 2 out of 50. Sticking to the original scale given by teachers makes a comparison awkward. Therefore in the following visualizations all assignments are scaled to 100. The usual filters mentioned earlier can be used to select particular assignments or tests, or to select particular users. Figure 3 and 4 shows two visualizations to explore performance concentrating on the diagrams.

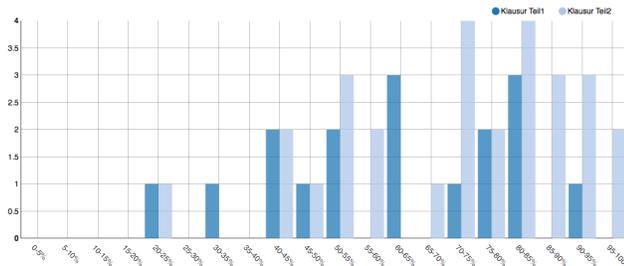


Figure 3. Comparing performance with marks' distribution.

The histogram Figure 3 gives an overview of the distribution of the students according to their marks. We can see that two

students are in the highest interval [95 -100] for the second part of the exam, called Klausur-Teil2, while no student has achieved this high performance in the first part of the exam, Klausur-Teil1. Again, the visualization is interactive. Cursor over a bar shows the exact number. The user can activate or deactivate any test or assignment by clicking on the circle near the name. A hollow circle visualizes that an assignment has been deselected. Appearance or disappearance of bars after activation, respectively deactivation, occurs progressively, so that the user can follow the change taking place.

A second visualization shows the box plots for all assignments. In Figure 4 the same assignments as in Figure 3 have been selected. It is possible to grasp not only that the maximum mark is higher in the second part of the exam, but also that over 75% of the students have done better, since the whole box including median is higher.

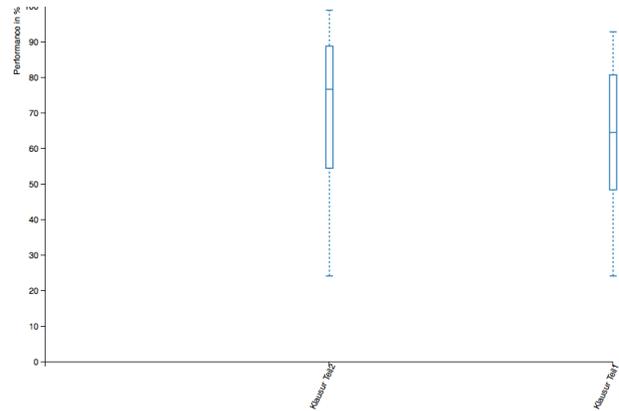


Figure 4. Comparing performance with box plots.

4. CONCLUSION

This visual exploration is the first step for analyzing usage data. When teachers grasp the overall trends in interactions and performance in their course, they should be able to deepen their analysis, seeking answers for questions such as: can students be grouped according to their performance? Or, dually, can assignments be grouped according to how students perform? Future work includes implementing means to help answering similar more involved questions. A challenge is to select the data mining algorithms and their parameters carefully so as to avoid misinterpretation of the results by stakeholders.

5. ACKNOWLEDGMENTS

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6. REFERENCES

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