

Learning Paths in a Non-Personalizing e-Learning Environment¹

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ABSTRACT

The project LeMo (monitoring of learning processes on personalizing and non-personalizing e-Learning environments) aims to develop a prototype of a web based Educational Data Mining application, which shall provide detailed information on user pattern within e-Learning environments and identify needs of enhancement and revision of the learning offer. The poster presents a case study of analysis of learning paths in a non-personalizing e-Learning environment. Research data have been obtained on the base of log-files during three arbitrarily chosen days.

Keywords

Learning paths, non personalizing, e-Learning environment.

1. INTRODUCTION

The LeMo project [1] is an interdisciplinary research project situated in the field of learning analytics, information science, psychology and data privacy. In order to obtain information about user patterns, as well as about the quality and optimization of e-Learning offers, we integrate in our tool several methods of data mining: association, sequential patterns, regression analysis etc. The tool will be used by eLearning providers, lecturers that use eLearning in different ways, writers of eLearning content and scientists in this field. The main goals for the prototype development are: a data source agnostic back-end, a set of analysis components and a dynamic and adaptive graphical user interface with strong emphasis on an intuitive and easy usability of the application. The prototype focuses on the e-Learning provider role.

2. THE TOOL

Being agnostic, the prototype will support different major e-Learning environments rather than a specific one. e-Learning environments can be classical learning management systems like Moodle, where a login personalizing the user is required for access, or online encyclopedias like ChemgaPedia [2] that are non-personalizing environments, where neither login nor registration is needed to access content. To the best of our knowledge, this feature is unique.

Connectors import user data from a specific e-Learning platform into a common data base used for analysis (Fig. 1). Currently two prototype connectors have been implemented, one for Moodle and another one for ChemgaPedia. Connectors for non-personalizing environments or online encyclopedias like ChemgaPedia have to remove fake user data that has been generated by web robots. Currently we have taken a quite cautious approach that might result in suppressing more user data than necessary.

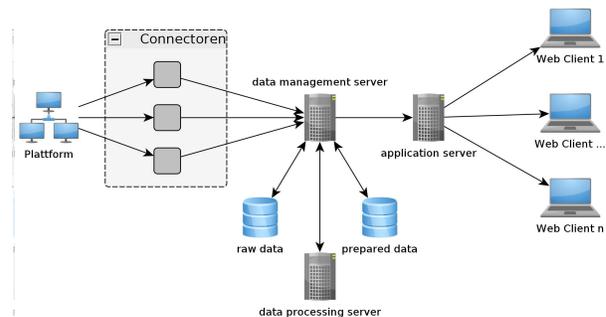


Figure 1. System architecture

The methodical guideline for the analysis components and for the adaptive graphical user interface is a catalog of more than eighty questions and research hypotheses collected from our university and business partners. These hypotheses and questions express the information that their authors would like to get from the users' data. The questions of this catalog can be divided into six groups assigned to six topics of analysis: 1. the learning environment, 2. usage of the learning environment, 3. user and groups of users, 4. learning performance, 5. learning paths through the learning environment and 6. communication tools.

Currently we are developing analysis components for topics 2 and 5. In particular we have implemented a component to extract learning paths of learners through the resources of courses. A path is a sequence of resources or learning objects ordered by access time. Each resource on the path is labeled by its name, a time stamp and a duration. The duration is simply the difference between the time stamp of the present resource and of the following one. The last resource of a path does not have any

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duration. A resource might appear several times on a path if a user consulted it repeatedly.

3. LEARNING PATHS IN AN ONLINE ENCYCLOPEDIA

As a first case study using the path component we have extracted paths of learners in the online encyclopedia ChemgaPedia. ChemgaPedia is a learning environment specialized in chemistry. The content is organized in subject; each subject is subdivided into branches and subareas, each subarea is divided into lessons. It is possible to obtain a lot of information about the usage of ChemgaPedia with GoogleAnalytics: total number of hits, where learners are coming from, on what pages they enter ChemgaPedia, which pages are accessed before leaving and so on. However, due to the high number of pages or resources in ChemgaPedia (more than 18 000), it is not possible, at least not for a non-computer science specialist, to follow paths of users within their session in the encyclopedia. We have extracted all user paths of three days usage data. An overview of the number of paths and their length that have been extracted is given in Table I. For length 10 and higher only samples are given, that should suffice to understand the trend. The second line of table I tells that 154 209 paths of length 1 have been extracted which represents almost 62% of all the extracted paths.

Length of path	Number of paths	Share
1	154 209	61.68
2	16946	6.78
3	4 066	1.63
4	2247	0.90
5	1404	0.57
6	969	0.34
7	666	0.27
8	478	0.19
9	351	0.14
10	301	0.12
14	86	0.03
17	45	0.02
20	19	0.008
24	14	0.007
27	1	0.0004
30	1	0.0004
34	1	0.0004

Table 1. Overview of the number of paths and their lengths

In this case study, paths are limited to a session within ChemgaPedia. For example, if a user accesses ChemgaPedia, clicks a few pages, follows a link outside ChemgaPedia and comes back to ChemgaPedia again, this will be counted as two different paths. The providers of the encyclopedia already knew through Google Analytics that many learners used the encyclopedia as a reference work, checking some specific information as needed, rather than studying full lessons. Our case study confirms this fact, giving a more precise overview: about 62% of the paths are consulting a single page, and almost 70% of the paths have a length of 6 or less.

Taking longer paths under the microscope leads to the discovering of different recurring navigational patterns: Some users study lessons thoroughly, clicking the pages in the given order and spending about 100 seconds on average on each page, which shows that they study a lesson the way as it has been designed. Other users go back and forth in a lesson, spending 10 seconds on average on a page, rather browsing than studying. This is another kind of information that the providers of ChemgaPedia cannot easily get with Google Analytics.

4. CONCLUSION AND FUTURE WORK

We are developing a tool to allow different actors of the educational field to explore how learners are using the e-Learning environment they study with. In a first case study we have extracted the learning paths followed by learners during a session with the freely accessible encyclopedia ChemgaPedia. This study confirms that the encyclopedia is primarily used as a reference. Examining longer paths shows that users are following different navigational patterns. This first result calls for future work in several directions. At first paths have to be presented graphically. Work along these lines is already in progress. Secondly it is not helpful to return numerous individual paths to a teacher, a summary is needed. We plan to investigate frequent sequences and clustering for that purpose. Finally it is also interesting to explore the most common navigational patterns to identify learning styles as proposed in [3].

5. ACKNOWLEDGMENTS

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6. REFERENCES

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