

Do IT and medicine students e-learn in the same way: Analysis considering collaborative modules

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Abstract: This study reveals comparison of patterns of behavior between students of medicine and IT students. Olap techniques have been used with the aim to determine possible differences. The research was conducted based on the received logs by Moodle system for learning management from Technical Faculty in Cacak, and Medical Faculty in Belgrade. Obtained results point towards the significant differences between these two groups, and the need for content adjustments in courses according to characteristics of different students' groups.

1 Introduction

Twenty first century introduced new era when dealing with web expansion, bringing along need for discovering and analysis of new behavior patterns. According to Cooley et al. [1], with the increase of information which are available on the Internet, it has become very important to analyze behavior patterns.

The first decade introduced a large number of universities with a rapidly growing number of e-learning technologies with the purpose of flexibility increasment education.

Internet expansion enabled distance education with the assistance of modern technologies, starting from the basic level of education to college education and specialization courses. The most important link in this chain is user of electronic course and that is why knowledge about user is very important.

The most frequently used software applications in higher education are called learning management systems (LMS). LMS is software that provides a virtual place for learning and teaching activities to occur within a seamless environment, one that is not dependent upon time and space boundaries [2]. LMS can be used for tracking learners abehaviour, since it logs practicaly every action a learner takes. One of the most popular LMS is Moodle.

According to Swedish National of Higher Education [2], it is necessary to apply the evaluation of courses if the quality of learning with the help of eletronic courses is to be provided.

Along with the appropriate analysis, logs are used for evaluation of students. Goal of the research is to determine which technique is going to be applied in the analysis.

This study presents the comparison of behaviour patterns between students who attend medical studies and IT students. Olap techiques have been used for log file analysis based on the example of Moodle system for learning management.

Olap techniques can be also successfully applied in log file analysis, but also for promotion of e-learning, according to [4]. Also, it is pointed to the fact that the Olap is the most logical way for analyzing organizations in [5]. In [6], authors give significance to Olap techniques used in the analysis of courses that are the most frequently visited, and in the analysis of the certain, most frequently visited pages.

2 Olap (On Line Analytical Processing)

OLAP (On Line Analytical Processing) is essential element of decision support, and it helps decision makers to better insight in the problem, giving them opportunity to analyze and understand it. According to Goyal [7] On Line Analytical Processing (OLAP) is a category of software technology that helps analysts, managers and executives to gain insight into data by using fast, consistent, interactive access to a wide variety of possible views of information. That information has a path on its own, because first it has to be transformed form data to information in order to be understood by the user.

Multidimensional paradigm in the form of data cubes is used by OLAP systems in order to organize the data. Every cube presents a combination of multiple dimensions with multiple levels per dimension. Dimension as a major analytical form, have attributes which are related to facts, forming a strong relationships, adding qualitative information to the numeric information contained in the facts. Olap cube is presented in the Image 1.

In this figure, members, cell, levels and hierarchy are shown for this specific example. A time dimension is also introduced so that behavior patterns that relate to the time activities can be compared.

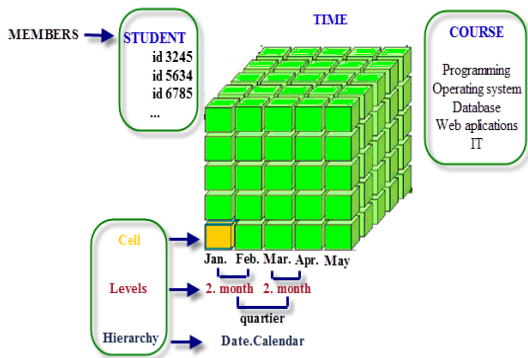


Image 1. Olap cube [8]

2.1 Purpose of the study

Detail monitoring of the user's activities is not predicted in the learning management system. That is why detail analysis is obligatory with other techniques, and Olap techniques are the ones that are used for analysis of user behavior patterns.

Goals of the research:

- Determination of the difference existence in the behavior patterns between students of medicine and students of informational technology.
- Professors will have an insight in students' patterns of behavior and they will help them to organize their classes so that students can be more active and learn better.

The objectives of the research:

- Data pre-processing: clean and prepare the Web server log file
- OLAP analysis: design a multidimensional structure in which the main factors under analysis:(year, month, day, time, minute, course, and module activity) will be taken as dimensions and later build OLAP cube in order to analyze the recorded data.
- Pattern evaluation: determination of behaviour patterns based on obtained reports and their evaluation
- Comparison of behaviour patterns between medical and informational technology students.

Hypothesis:

1 H0: There is no significant statistical difference between IT students and medicine students in access to collaborative modules (chat, forum).

H1: There is a significant statistical difference between IT students and medicine students in access to collaboration modules (chat, forum)

2 H0: There is no significant statistical difference between IT students and medicine students in access to collaborative modules (chat, forum) during the day

H1: There is a significant statistical difference between IT students and medicine students in access to collaborative modules (chat, forum) during the day

2.2 Methodology

OLAP have been used in this study in order to detect and analyze behavior patterns.

Before the process of OLAP application begins, it is necessary to conduct pre-processing of log files gathered from servers.

Pre-processing is a phase that includes removal of entries containing errors. The reason for that lies in the fact that those entries are not relevant for this specific research. Besides, time is presented with columns that include: year, month, day, hour, minute, and this kind of presentation differ from the originally obtained format from the Moodle server log file. Columns that relate to additional information and to URL of every page are irrelevant for this research, and therefore excluded from log files.

After the pre-processing, Olap cube and dimensions are being created. Microsoft Visual Studio 2008 [8] is used for creating of dimension and Olap cube. Data Source and Data Source View have to be created before the creation of a cube. Data doesn't originate in an OLAP database; it uses another database as a source, in this case relational database. Figure 2 shows Data Source, Data Source View, and cubes. After creating initial data source, Data Source View is created. Data Source View has two aims:

- It permits identifying which tables and views from the data source will be used in concrete Analysis Service Project
- It retrieves and stores the metadata about those object allowing building cubes without having to maintain an active open connection to the data source

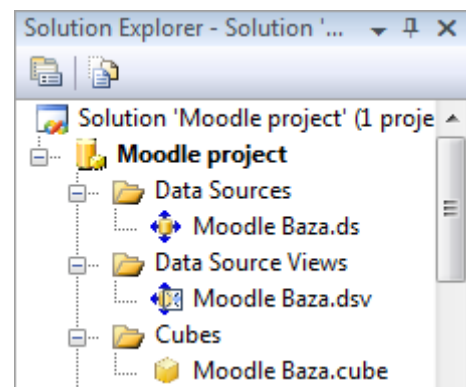


Image 2. Illustration of Data Source, Data Source View and Cube in Solution Explorer-u

After that the dimensions and cube are created. Creating dimensions and cubes leads to the final phase of work in Visual Studio. This phase involves deployment solutions. Deployment solution passes several phases, and the result is successfully completed deployment to continue the work within SQL Server Management Studio and. Figure 3 shows the successful deployment solutions.

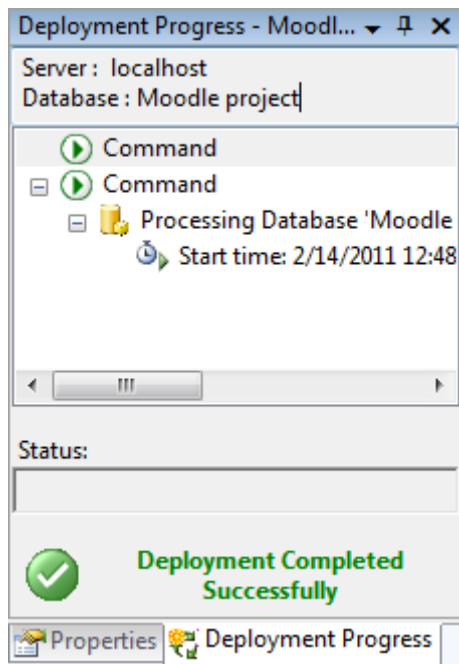


Image 3. Illustration of deployment solution

After successfully completing a deployment solution, passes into to the SQL Server Management Studio [9]. In this environment, the first connects to Analysis Services, and then to browse the cube.

In further analysis the statistical methods ANOVA and MANOVA were used to determine if there is a statistical difference between different student groups.

2.3 Participants and tools

The study was conducted with the cooperation between Technical faculty in Cacak, and Medical faculty in Belgrade. On both of mentioned faculties traditional learning is combined with e-learning with the assistance of Moodle LMS.

Table 1: Analysis of variance (ANOVA) for IT and medicine students

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	341231688	2	170615844	2.847773581	0.135018	5.14325285
Within Groups	359472070	6	59912011.67			
Total	700703758	8				

Table 1 shows variance analysis of different groups and within group analysis. Data important for hypothesis test is given in columns F, F crit, i p. In table 1 is shown: the sum of squares (SS), degrees of freedom (df), mean square (MS), $F = \text{Between treatments mean square} / \text{Residual mean square}$, p-value P value answers this question: If all the populations really have the same mean Having $F < F_{crit}$, the null hypothesis is accepted. Hence, there is no significant statistical difference between IT students and medicine students in access to collaborative modules. The p-value also indicates that the null hypothesis should be accepted, because $p > 0.05$. Having in mind the fore mentioned, when creating Moodle courses for IT students and medicine students there is no need to make a difference in modules application. Both groups

Since 2007, Moodle LMS (<http://itlab.tfc.kg.ac.rs/moodle>) has been used at Technical Faculty in Cacak. Within this system, more than 100 courses have been developed, and over 50% of them relate to the Informational Technology. The number of active users from system the logs were used was 1821. Number of records from this system, used in analisis is 67 875.

Medical Faculty in Belgrade has used Moodle LMS (<http://moodle.med.bg.ac.rs/moodle>) since 2004. There are 29 courses in this system, and all of them relate to medical courses, and subjects that are the objects of this faculty. The number of users from system the logs were used in analisis was 32. Number of records from this system, used in analisis is 85654.

As we have already mentioned earlier, Microsoft Visual Studio 2008, Microsoft SQL Server 2008 and Microsoft Excel (for result visualization) have been used for this research.

3 Results and discussion

In this section, results and discussion of the research are presented. Gathered results indicate possible difference between IT and medicine students through several aspects. In first the modules which enable collaborative learning (chat, forum), in further text referenced as collaborative modules, were analyzed. Wiki pages also counts as collaborative modules, but these were not included in analysis, because not both of system courses use them. Using one-factor analysis of variance the statistical difference between different student groups was determined regarding access to collaborative modules. After that analysis, the groups' comparison of access to collaborative modules during the days and hours was conducted. Results are compared within discussion.

access these modules without significant statistical differences. However, although there is no significant statistical difference between two student groups in access to collaborative modules, it is possible that there is a difference in time when students from different groups access modules. Therefore, it is mandatory to make a time analysis of access to collaborative modules. It is conducted using MANOVA technique, and it is shown in Table 2.

Table 2: MANOVA for IT and medicine students

Source of Variation	SS	df	MS	F	P-value	F crit
Rows	4894910	94	52073.51	1.011776	0.466001	1.331981
Columns	6675101	2	3337551	64.84783	3.82E-22	3.04398
Error	9675875	188	51467.42			
Total	21245887	284				

Since it is $F < F_{crit}$ (Table 2), the null hypothesis is accepted. Hence, there is no significant statistical difference between IT students and medicine students in access to collaborative modules during day. The p-value also indicates that the null hypothesis should be accepted, because $p > 0.05$. These conclusions are related to determining potential difference between groups, as it is seen in line with label Rows. Having in mind the fore mentioned, there should make no difference regarding time organization of collaboration modules for IT students and medicine students.

4 Conclusion

Along with the increased use of system for learning management, a need for behavior pattern analysis appears. For the specific need of this research Olap (as one out of many techniques that are used for this purpose) has completely fulfilled the goal of this research. This research was aimed at determining differences between students of IT and medicine in learning domain, inside collaborative modules. The results show that between students of IT and medicine there is no significant difference in time of access to these modules.

Research's drawback is found in different organization of courses, within the students from watched groups learn. It can be overcome creating uniform courses for both groups and redoing the research. Also, the drawbacks are indicated by different number of students from both groups involved in research. It is overcome by using similar number of records.

Advantages of this approach are seen in its efficient analysis of large data with option of getting precise information about user behavior patterns.

Considering the research results, the design of Moodle electronic courses in domain of collaborative modules should not be different for examined student groups. Future work is pointed toward analysis extension on other module types inside Moodle e-courses.

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