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APPLICATION FOR TRACKING STUDENTS' EFFICIENCY AND PREDICTING EXPECTATIONS BASED ON CURRENT RESULTS

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ABSTRACT: Globalization and technological development are radically changing the landscape of higher education. Students increasingly expect to choose what they learn, how they learn and when they learn, according to their individual needs and interests. Computer applications in education system introduce unique technical, managerial and most importantly pedagogical issues. Using business discovery platform QlikView, application developed in this research, should be beneficial to both, students and professors at the university. The relation database model is based on data collected from student admission service of Faculty of Organizational Science, University of Belgrade. Application allows students to analyze current study success, but also to predict future performance success. In addition, students can use developed application as an advisor system, which can be useful in helping student plan for the upcoming semesters and also to be able to answer any questions that the student may have regarding his/her academic standing.

Keywords: knowledge-based application, student study success, higher education

INTRODUCTION

The use of modern technological resources and teaching aids, as well as the adjustment of teaching content to students, in order to achieve better results in the adoption and application of knowledge, may represent a good basis for the development of contemporary concepts of education in the 21st century. In order to achieve this, it is necessary to detect, define and analyze existing patterns of behavior and students' learning. Today, there are a large number of software products for facilitating and improving the quality of learning. Some of them are intended for students of primary schools and high schools, while the other are focused on college students. Exactly the last mentioned type of software represents interest of this paper.

In this paper, the introductory part will present related works and background of the methodology in area of educational administration software. The basic concepts of QlikView software platform and developed Academic Dashboard for Faculty of Organizational Sciences, University of Belgrade will be analyzed in the central part of the paper. The final part of the paper defines the guidelines for further development and adaptation of higher education system to the necessities of a student.

METHODOLGY and TECHNOLOGY SUPPORT

Methodology background and related works

Technological development has provided base for developing software with new functionality. Teaching process records constant improvement through the use of ICT (Arenas-Marquez et al, 2012). Nowadays, providing students with services they expect is more challenging than ever before. Some of those services are ability to track current students' achievements and results, planning next semester, conducting optimal selection of exams based on preferences and results, operational planning, like attending colloquia, exams, participations in projects and practices etc. Also, that kind of software is attended for professors in order to track effectiveness of students

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(individually, by teams or by generation) and for planning and adapting exams curriculum in order to meet future interest of students. Some of those are open source (Coll et al., 2008) and others are vendors' solutions. Software scope and architecture may vary and below is an overview of the most significant solutions.

IBM company provides personalized software package SPSS for students and teachers. This software integrates different types of data analysis, data mining trend research and quantitative methods for measuring efficiency. Students can plan obligations, track and analyze exams' results, use tools for advising etc(IBM, 2014). Beside this software, students can customize and use IBM's BI tool, named Cognos. Because of its complexity and detailed analysis, usage of SPSS or Cognos can be demanding and difficult, especially from a student point of view.

SAP offers solution to support the work of students and teachers. Integral parts of this software are: Student Lifecycle Management, Teaching and Learning, Learner achievement Measurement and Tracking and Educational Performance Analytics (SAP, 2014). This software is a feature-rich, both for the students' and teachers' work. Student can plan and monitor present liabilities in the current semester, monitor different statistics of their past achievements and use adviser in order to get proposal of exams in subsequent semesters, use distance learning etc. Moreover, students can run "what-if" scenarios to view requirements for a program being considered, including courses adequate for transfer if they changed programs. Mentioned software allows professors to plan classes and the necessary resources (personnel, classrooms, technical resources), to monitor the presence of students (status of their obligations, progress, rating), to define grade scale, to evaluate test in-time and to send test results to students, to propose future courses based on interest of students, to optimize study process and to carry out large number of statistical analyzes.

Microsoft offers multiple solutions to support students and teachers by personalizing product from the Dynamics family or using dedicated software like: Communication and Collaboration, Device Management, Web Portals, E-learning and Tracking Institutional effectiveness for Higher Education. These software solutions allow quick and easy connection and communication between students and teachers through various types of devices, easy scheduling obligations both students and teachers in accordance with number of registered students, retention of various records. Using this software, teachers can easily perform different analysis, support online teaching, testing and decision-making. Also, all of mentioned software solutions are easy to integrate with other Microsoft's products (Microsoft, 2014).

In addition to the mentioned software there are some open source solution (qOrganizer, Planbook, StudentLife, TeachersPlanner, and StudyMinder). Characteristic of all listed open sources software solutions are that they allows only a slight adjustment to a specific software system and essentially real system needs to adapt to software requirements (called personalization process). This paper will present how to develop custom applications based on both existing data, collected from student admission service of Faculty of Organizational Science (University of Belgrade) and the required functionality. Technology used for this solution is QlikView.

QlikView technology

QlikView represents new patented software engine, which compresses data and holds it in memory, where it is available for immediate exploration by multiple users. QlikView delivers an associative experience across all the data used for analysis, regardless of where it is stored, (Harmsen, 2012). For datasets too large to fit in memory, QlikView connects directly to the data source and generates new views of data on the fly. QlikView's patented core technology, associative experience, and collaboration and mobile capabilities, make able to work with a lot of questions, passing by traditional hierarchical models, with created an associative network which works similar to human brain. Empowering the information workforce to derive insights from data helps organizations streamline, simplify, and optimize decision making, (Harmsen, 2012).

In primary frontend-backend architecture, on which is based QlikView solution, as data layer (Infrastructure resource) will be used relational database to record data on students of the Faculty of Organizational Sciences. Using OLDB connections, QlikView server will establish communication with the database with students data within specific time intervals (monthly level or after completion of the exam period). Once the connection between QlikView and elementary student database is established, the application will use the Associative Query Language (AQL) to download data from the relevant tables, necessary for the operating and usage, and after that it will be stored in its own memory. In addition to downloading data, backend part of application will be

provided with ability to define application logic, rules for establishing a link between the data (in accordance with already defined relational model), as well as methods and privileges for using the application. Within the frontend, according to the rights they have, each user will be able to access the application and review it available reports and data.

STRUCTURE OF DATA MODEL AND APPLICATION

Similar to QlikView usage in public or private sector, we developed QlikView Academic Dashboard for Faculty of Organizational Sciences, University of Belgrade, in order to help educational professionals and students to maximize data governance and optimize their intellectual investments by discovering how QlikView is used at a granular level in educational sector. With this application and resulting knowledge, professors and students can introduce more manageable and repeatable educational processes, as well as address data lineage and impact analysis questions on more efficient way. Approach of developing an integrated system for students and teachers has considerable benefits for improved data quality, mainly due to the fact that integration obviates the need for complex interfaces (Berkhoff et al., 2012).

The data contained within this application represents student personal, demographic and academic data, collected from student admission service of Faculty of Organizational Science, University of Belgrade. Using this data we can analyze the demographic and socio-economic student structure and success at the University. Developed relation data base model consists of 15 objects and more than 50 attributes.

Using the student grade data, an academic advisor can guide the student as to which classes still need to be fulfilled before graduation or how to improve current GPA (grade point average). Professors will be able to monitor students' achiness and success by each study program, student gender, finished high school, exam, semester or science filed. Application allow students to analyze current study success, but also to predict future success performance based on average exam performance from other students whit same background. Students in addition can use developed application as an advisor system, this data is useful in helping students plan for the upcoming semesters and also to be able to answer any questions that the student may have regarding his/her academic standing. This application, also, takes advantage of security level setup using section access to show different views of the data, including two basic views: a professor view and a single student view.

RESULTS and FINDINGS

Professor View for Academic Dashboard for Faculty of Organizational Sciences

Academic Dashboard for Faculty of Organizational Sciences allows professor and administrative staff to view a breakdown of demographic data such as gender, ethnicity, class standing and province of residence. Using these data fields they can identify trends and also can get an overall picture of the demographic breakdown of the faculty and students.

Teaching staff will be able to monitor success of students in each of the courses for which they are responsible. Data for each subject will be available in different time units: specific examination period, semester, school year, calendar year etc. Teachers will be provided with option for tracking students' success on multiple courses, for example group of courses for which a particular teacher is in charge. As it shown in Figure 1, professors can keep an eye on data such as GPA, average study length, entrance exam points by country, region and high school type for each generation of students. That kind of observing students' success can be of great significance in determining trends in college enrollment.

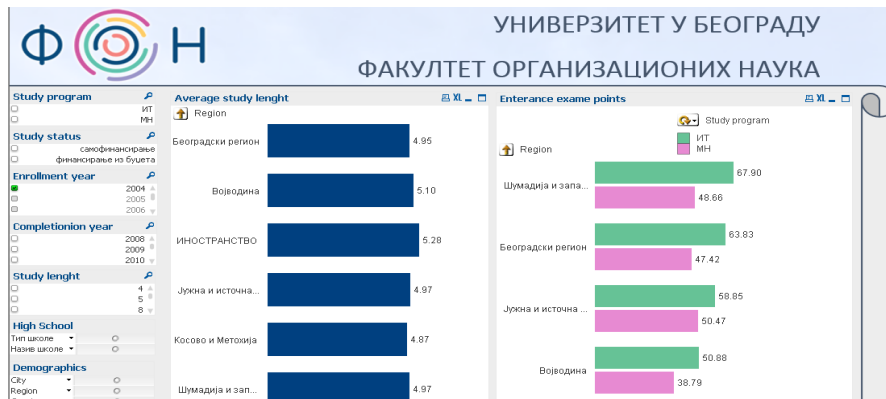


Figure 1. Students' success by Region

In order to identify, for example, gender structure and study success, on each study program by different success criteria, on both global (GPA, average study length, average entrance exam points) and individual (exam, semester, specific examination period) level, just by selecting adequate view, time period and desired variable, as it shown on Figure 2. Professor can switch to a chart view of GPA and see the disbursement of current GPAs on student, course or exam level, and with that like organized data, professors can look for trends in GPAs and get a high-level view of how our students are performing. Selecting from the list boxes on the left they can filter the data down to a particular major and/or course.

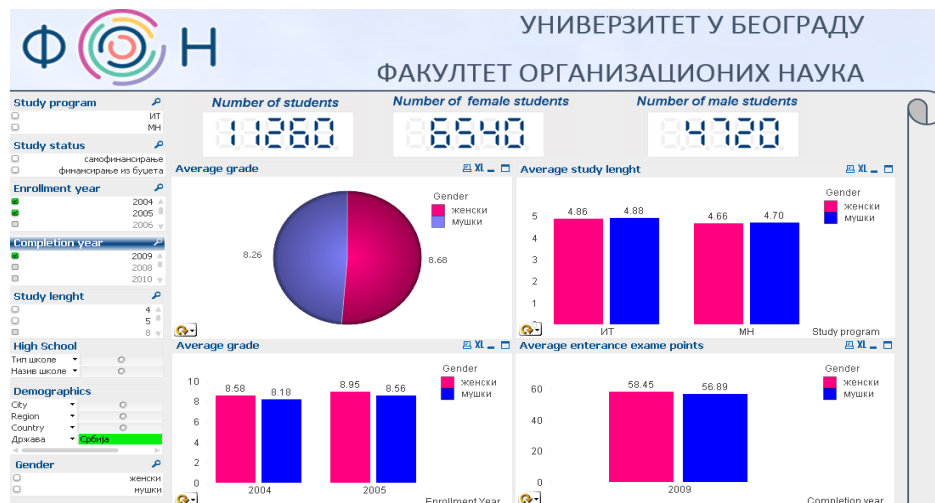


Figure 2. Detailed success statistic by student gender

Observing student profile a professor or educational office staff, as administrator, can see the academic data for any of the students enrolled in the faculty. Once the administrator identifies a single student, he/she can then get a look into that student's current academic state on more detailed level. Data such as cumulative GPA, declared major and minor, courses taken, remaining courses needed to fulfillment major requirement, and address information. As an advisor, this data is useful in helping the student plan for the upcoming semesters and also to be able answer any questions that the student may have regarding his/her academic standing. Through continuous monitoring of students during their studies, at an early stage, teachers can perceive students with good potential and students who need extra help in order to improve their results. The best students can be offered extra activities, for example additional courses, participation in scientific research and projects.

Student View for Academic Dashboard for Faculty of Organizational Sciences

Through interactive forms (and with adequate data security mechanism), students of the Faculty will be provided with the ability to monitor continuously their progress during the study (number of exams, grades etc.), as well as their ranking relative to other students from the same generation and on the same study program, as it is presented on Figure 3. This functionality commonly gives extra value for quality assurance processes in higher

education (Seghedin). After completing the first year of undergraduate studies, using the application, students will be able to review the predicted potential success at the end of the study, which is certainly a good indicator and a guideline for further technical and scientific development.

Another important benefit of this software represent fact that it is provided as SaaS(Software-as-a-Service), which is defacto increasingly important paradigm in information technology and also provides education systems as a service for enhancing processes in higher education (Masud & Huang, 2013). This functionality enables students with an easy-to-use application, for which utilization they only need web browser and permitted access to application.



Figure 3. Students' success on individual level

The Student View shows a single student's academic data. Additionally, students can also use the "What-If" scenario to allow the student to hypothetically change his/her major and see the immediate impact that decision would have on the required courses necessary to fulfill the major requirements. Also, students will have ability to compare personal results (GPA or special exam grade) with success of other student in a class or with students with same demographic characteristics.

CONCLUSION

System model for recording and monitoring study performance, presented in this paper, can be used as a good basis for improving the process of higher education. The developed system aims to provide teachers with tracking functionality in order for continuously monitor students' achievements. Also, application allows them to compare students' success categorized by courses, science-education groups or exams periods. Based on these information professors can determine the patterns of students' aspirations and needs, which can directly improve the process of education.

In addition to relations that indicate dependency between of students and their success, the developed system (based on QlikView in- memory solution) allows as well identification of relationships that are not directly related to the success in studies. Example for previous would be possibility for linking student with list of elective courses and optional seminars, that they have chosen. This possibility provides students with advisory tool for choosing courses in the following semesters, gives guidelines for further scientific and professional development of each individual and also contributes to the prediction of the expected popularity of the elective subjects in the future.

Directions for future research are further improvement of the system in terms of development of modules for prediction students success and for their positioning and ranking among other students in their generation.

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