

INFORMATION SYSTEM IN THE FUNCTION OF A QUALITY SYSTEM DEVELOPMENT ILLUSTRATED IN THE EXAMPLE OF A SERBIAN ACADEMY OF APPLIED STUDIES

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Abstract: *In this paper we presented the information system of the Academy of Applied Studies in Serbia named ATEIS (Advanced Tertiary Education Information System), which has been developed at the College of Chemical Technology in Kruševac, and for the purposes of the Tempus ECBAC project. The ATEIS was modelled on the information systems of the following European higher education institutions: Katholieke Hogeschool Sint-Lieven (Catholic University College in Gent), Polytechnic Institute of Porto (IPP), and Hochschule Aalen, and it was designed to be used by domestic partner institutions. The system encompasses Student Service Application, Students Application, Professors Application, as well as Quality Assurance Application. The ATEIS information system was developed on a multilingual platform based on the PHP and Ajax languages. For the purposes of data storage and archiving it uses the MySQL database. The PHP platform provides a secure access to the aforementioned database directly from the server, while the Ajax and JavaScript make the user interface user-friendly. After a brief description of the aforementioned panels, as well as the technology and methods of statistical data processing, the development of the Quality Assurance Application was presented as an element of an integral information system. The ATEIS monitors the most significant static and dynamic characteristics of the Academy which enables the use of available resources, as well as upgrading and specialising in the development of quality systems.*

Keywords: *Information System, Quality Assurance, Quality System, Data Processing*

JEL Classification: *I21, I23, I29, C38, C45, C46, Y10*

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1. INTRODUCTION

Integration processes in the European Union are very important, especially in the sphere of education. National economies become increasingly connected and interdependent. Deepening of economical, scientific and technological relations among various countries is a result of the development of productive forces which show a high concentration of knowledge and capital that require a more powerful scientific base, huge markets and a large amount of energy and resources. In recent years, quality assurance has become a global process through education internationalisation. The application of international standards, quality control and improvement have become the imperatives of modern education.

On the basis of positive experiences in forming similar institutions in the European Union eight colleges of applied studies ventured into forming the first Academy of Applied Studies through the realisation of the Tempus ECBAC 517200 project.

The first steps towards forming the Academy and establishing its capacities lie in common frameworks in the fields of quality assurance, student service, IT service and international office. Quite aware of the fact that nowadays it is necessary to comparatively and interdependently develop the systems of quality assurance and information technologies, the development team of the IT service of the Academy approached the development of a unique information system. The entire process of quality system management has been described in the files of the Quality Assurance Service of the Academy, and the topic of this paper is the implementation of the aforementioned process through information technology support by means of implementation of applicable solutions.

1.1. Information system of the Academy of the Applied Studies

The Academy of Applied Studies is committed to realising the Bologna Process as successfully as possible. Bearing in mind the significance of quality from the standpoint of keeping up-to-date with modern trends, the consortium of the Academy adopted the common quality assurance policy. The goals of quality improvement within the Academy comprise the following:

- providing an active support for every participant in the process of education (teaching and non-teaching staff, as well as students) in their effort to improve their own quality;
- emphasising the importance of education quality improvement and defining measurable indicators of quality criteria;
- introducing a system for the assessment, monitoring and improvement of every participant;
- improving the quality of inclusion of every participant

The Quality Assurance Service submits semi-annual reports regarding the outcomes and evaluations representing the extent to which the Academy functions according to the principles of the established efficacy. All services take care of the specific needs of every department, study programme, semester, course and staff member. The Commission report is represented to the public in all available forms. The information system follows the most significant static and dynamic characteristics of the Academy, which enables the use, specialisation and upgrade of all available resources in the process of system development. Through static and dynamic characteristics of the Academy one shows the usability, functionality, performances, as well as the economical and technological limitations.

The most significant characteristic of the information system is a support for the quality of the teaching process and the ability to adapt to quick changes, not only in the immediate (national), but also in the global environment.

The role of the information system in monitoring the quality of teaching process in schools is of the utmost importance. The system of quality as a basis of a regulated education system represents the necessary condition for the development of a decent information system. The issues of defining clearly delimited

responsibilities within the Academy, as well as quality assurance policy, and relying on globally recognised standards are some of the issues which represent the basis of the information system.

1.2. Technical features of the information system

During the development of the ATEIS main tasks were:

- storage and organization of large -scale data
- data security and confidentiality of information
- access to data
- different levels of access to data
- automated data processing
- different types of users

Based on these requirements relational database and Web technology were selected provided by its access and update . In this way, the data that is mutually correlated is optimally connected, and access and update could be provided from different locations and with more clients simultaneously. For the realization MySQL database and web programming language PHP and JavaScript were used . ATEIS has multiple levels of data access , depending on the class of users. Classes of users are:

- Student Service
- Lecturers (professors and assistants)
- Quallity Assurance
- Students
- The Ministry of Education

The functions of each class of users and processing capabilities of the data are clearly defined and limited.

Because of the potential web access to the system , special attention was paid to data security . On ATEIS all existing protection systems ranging from server of certification , encryption , user names and codes over other solutions in the implementation were used.

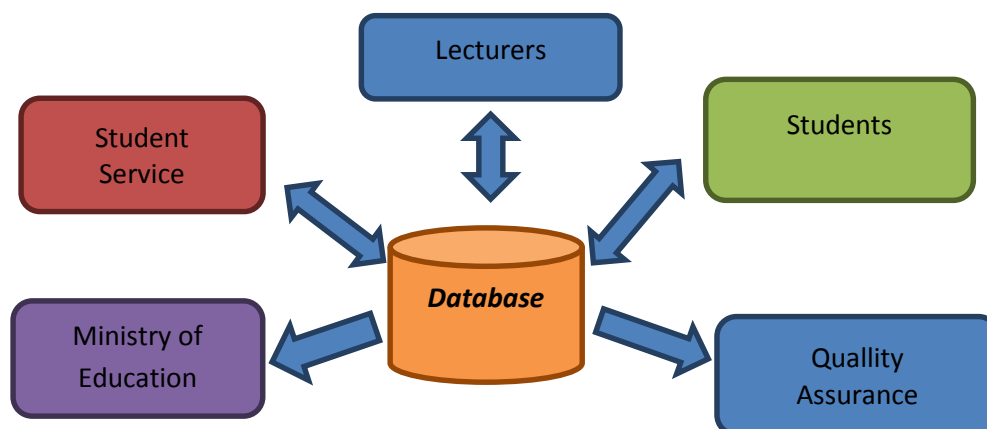


Figure 1. Organisation structure of ATEIS informational system

The database contains more collection of data organized into different classes or interconnected . In addition to the basic master data recorded on students and their activities :

- pre-exam activities
- logged exams and exam results
- payment
- transfer of ESBP points
- assessment of teaching staff and services by students

The ATEIS database represents a valuable source of information for analysis and prediction . But most of all for the advancement of education of students .

1.3. Data analysis

Data stored in the database are subject of further analysis and processing. Different tasks can be applied, such as the following general tasks from the domain of low-level user activities:

- value retrieval – finding of specific attribute values for data cases (e.g. find when the student passed the given exam and with what grade),
- filtering – finding data cases which satisfy the given conditions in relation to their attributes (e.g. find the students that have qualified to do the final exam),
- compute derived value – finding the appropriate aggregate numerical value for data cases (e.g. find the average grade for the given course in the given time),
- find extremum – finding data cases with extreme attribute values (e.g. find the student with highest average grade in a school year),
- determine range – finding the range of attribute values of interest for data cases (e.g. find the span of the results of pre-exam activities for a given course),
- characterize distribution – finding the distribution of the quantitative attribute of interest for data cases (e.g. find the distribution of the grades for a given course at a given time),
- find anomalies – identification of any anomalies with respect to a given relation or expectation, i.e. statistical outliers (e.g. find the students that did not attend any lecture for a given course),
- clustering – finding clusters of similar attribute values for data cases (e.g. divide the students into two groups according to their previous grades in order to give lectures at two different levels),
- correlation – finding useful relations between values of two given attributes for data cases (e.g. find the correlation between the pre-exam and the exam results).

As can be seen, the suggested starting framework for the data analysis offers a very broad spectrum of useful applications which should certainly contribute to the quality of schools' functioning. Also, it is easy to imagine a specific analysis which can be included into the information system as one of the indicators of the quality of professors' work. For example, if one professor has correlated bad indicators for multiple courses (e.g. low attendance), that should probably represent a certain sign. Of course, it is possible to imagine a different scenario, where, for example, survey results from the students that did not attend the lectures would not have been taken into the consideration.

Advanced techniques of data analysis can be relatively easily embedded into the existing general framework of the information system, if there is a specific demand. Various techniques from the domain of artificial intelligence aimed at expert systems are available, such as pattern recognition, neural networks, fuzzy logic etc. It should be emphasized that the development of these techniques can represent an academic activity per se, which can include professors and students and contribute to their mobility and to the cooperation between different institutions.

1.4. Surveying and gathering the data relevant for the Quality Assurance Service

The ATEIS is intended for supervision, communication, archiving and student data administration during three-year vocational studies, which immensely facilitates the process of gathering relevant data connected with quality and statistical analysis. It should be emphasised that the entire system is automated (it is automatically determined which courses students attend within a particular study programme, which exams they have the right to apply for and take, how many ECTS points they have the right to transfer, what the status of a student is, conditions, etc.), as well as that data gathering is done on all users in one data base. On request, relevant data are distributed in either original or processed form for the purposes of a specific student service. This facilitates the work immensely and increases the efficiency and productivity of the Student Service. Personal data entered in the register are collected, processed, kept and used for the purposes of educational policy in accordance with the Law on Personal Data Protection.

The functions and possibilities of the system are manifold. In the paper we will present only those functions the purpose of which is to gather data significant for ensuring and improving the system of quality.

The functions of the Student Service are: the possibility of communicating with students and employees via notifications (this function significantly saves paper consumption regarding printed notifications...); monitoring and recording student files (Register Book and ŠV-20 form); keeping records of the language of study programmes, mandatory and optional courses, foreign languages, data on pre-exam activities, data on the exams taken, pre-exam evaluation marks, earned ECTS points, data on awards and commendations received during the study period, as well as on issued public documents.

The basic functions of the application intended for the students encompass the transfer of all administration activities which students usually perform over the Student Service window to the Internet environment. As a result, the load of student administration is reduced and administrative procedures are accelerated. Likewise, easy categorisation and data processing leave little room for errors, which can occur at the peak of exam and entrance terms, thus influencing favourably an increase in the quality and professionalism of the institution. In the student survey panel students can anonymously fill in the questionnaires sent by the Quality Assurance Service. Filling the questionnaires is fairly simple and does not require a lot of student's time. In case that a student does not fill in the questionnaire all his/her activities in the panel are blocked until they finish the process. The data obtained through the survey are anonymous and in accordance with the Law on Personal Data Protection the purpose of which is the anonymity of students and the exclusion of the possibility of unintended consequences. A systematic examination of students on the quality of work of the teaching staff is realised by the Quality Assurance Service. The evaluation is done through the specific questionnaire for the evaluation of the teaching staff. The goal of this examination is offering feedback information to the teaching staff on their quality of work in the teaching process and while working with students. By means of communication with students and their representatives the teaching staff are obliged to offer a review of the conducted survey and together with students analyse the fields in which changes are necessary. If some teachers do not change for the better in spite of the negative feedback, it becomes a very important criterion in the process of their reappointment. In the current phase of education development, a success can be secured by a more intensive orientation to people. This issue concerns the deciding competitive advantage which can be secured with highly competent and capable employees who are ready to achieve a certain level of performance. Every change in education is a learning process for many individuals, and quite often even for every single employee. The changes can be conducted without frustrations and dissatisfaction only if every person concerned is included in a timely fashion and if they are certain that they can give their contribution. In order to achieve the planned behavioural change everyone needs to be clear about the traditional, current norms of behaviour, and then compare them with the desired ones, i.e. with the norms of behaviour of the future. If changes in education imply certain changes in one's behaviour, we inevitably enter the cultural domain of the Academy. Changes in behaviour always cause the changes in attitude, which can be achieved only when one is certain about the necessity of such a change and the validity of the new norms of behaviour.

The menu consists of four groups of links for the evaluation of the survey items connected with general questions, study, course and teacher evaluation, and the Academy Services evaluation. By clicking on the link within the menu in the central part of the page one opens the content regarding the chosen link. The group of links for general questions, study evaluation and service evaluation is common for all students of all the departments of the Academy and for all study programmes. The links within the group for course and

teacher evaluation contain the list of courses which a student attends in the current semester or school year, depending on whether the survey is conducted for one of for both semesters. The students of a specific year and study programme are offered a list of all courses for the given year of study and study programme. The initial content in the central part of the page represents a short instruction for students on the manner of completing the questionnaire and the goals of electronic survey.

Anketa

Ocena studija Ocena predmeta i profesora Ocena službi

Pitanja za predmet: Osnovi informaciono komunikacionih tehnologija

Izvršavanjem predispinih obaveza olakšano je polaganje ispita.	<input type="radio"/> 1 <input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5
Neophodna literatura potrebna za ovaj predmet nalazi se u biblioteci Akademije.	<input type="radio"/> 1 <input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5
Literatura je usaglašena sa nastavnim planom predmeta.	<input type="radio"/> 1 <input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5
Obim sadržaja predmeta odgovara predviđenom broju časova predavanja i vežbi u semestru.	<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input checked="" type="radio"/> 4 <input type="radio"/> 5
Na početku semestra profesor je predstavio plan nastave sa jasno definisanim obavezama i pravima studenata	<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input checked="" type="radio"/> 4 <input type="radio"/> 5
Profesor redovno održava nastavu.	<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input checked="" type="radio"/> 4 <input type="radio"/> 5
Profesor je pripremljen za nastavu i dobro poznaje materiju koju predaje.	<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input checked="" type="radio"/> 4 <input type="radio"/> 5
Odgovarajućim primerima iz prakse, profesor olakšava razumevanje materije.	<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input checked="" type="radio"/> 4 <input type="radio"/> 5
Profesor je dostupan za konsultacije	<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5
Profesor je otvoren za diskusiju o gradivu.	<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input checked="" type="radio"/> 4 <input type="radio"/> 5
Profesor je profesionalan i korektan u komunikaciji sa studentima.	<input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input checked="" type="radio"/> 4 <input type="radio"/> 5
Profesor objektivno ocenjuje znanje studenata.	<input type="radio"/> 1 <input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5
Profesor uslovljava polaganje ispita kupovinom njegovih knjiga-skripti.	<input type="checkbox"/> Da <input checked="" type="checkbox"/> Ne <input type="checkbox"/> Delimično
Primedbe:	<input type="text"/>
Pohvale:	<input type="text"/>
Preporuke:	<input type="text"/>

Pošalji odgovore i pređi na sledeći predmet

Moj dosijje
Aktuelni ispitni rok i prijava ispita

Figure 2. Part of the student questionnaire panel

1.5. Quality evaluation and presentation of the analysed statistical data

Quality evaluation is a systematic and elaborate process. The reasons lie in the fact that each one of us attaches special importance and value to the way we perform at work, especially if we are convinced that we always give our best. The evaluation of the teaching staff quality is done on the basis of the criteria assigned by the Senate of the Academy. Commitment to work, enthusiasm, attitude, willingness to cooperate, responsibility, motivation, discipline and ambition are characteristics deeply ingrained in our personality and can be changed very slowly and only through significant difficulties. When the results of the survey are joined with specific desired levels of success, the mark of quality is no longer subjective. Each individual knows what he/she is expected to do. What is more, every individual can plan his/her own quality. The kind of control secured in this fashion is objective and ensures improvement.

Application panel intended for the Quality Assurance Service comprises the following:

- The possibility of sending notification to the staff (according to the study programmes, modules or individually)

- Monitoring of all data necessary for the Quality Assurance Service which are in accordance with the Law on Personal Data Protection
- Creating and sending questionnaires to students (in case that students do not fill in the questionnaires their student panels are disabled, as well as their activities in student administration, until they fill in the questionnaire)
- Overview off the results of the survey and statistical processing of all data which are of any interest for the improvement of the quality of higher education institution
- Graphic display of the results of the survey

Profesor: dr Marko Marković		Prosečna ocena profesora: 4.5
Prolaznost na ispitu:		
Ocena:	Broj ocena	Procenat:
10	2	6,66%
9	3	10%
8	7	23,23%
7	5	16,66%
6	10	33,33%
5	3	10%

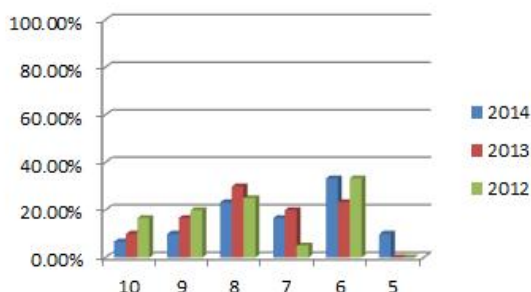


Figure 3. Exported results of student survey

2. CONCLUSION

The very first Academy of Applied Studies in the Republic of Serbia is committed to working according to the highest international standards regarding higher education by respecting the established international norms, the regulations of the Republic of Serbia, as well as the norms established by the Academy itself. The entire staff and students need to abide by the established norms, as well as to work continuously and systematically on the quality improvement.

By using the presented information system the management of the Academy and the Quality Service are enabled to exercise continuous and systematic control over the realisation of accepted standards and to conduct corrective measures if there should be any kind of deviation. The information system focuses on the opinion of students as the highest level of quality system abstraction. Owing to its modern structure the architecture of the information system can precisely adjust to the requests of the system of quality, and owing to its openness it can be combined with the applications defined earlier. The designed information system offers quick and efficient introduction and flexibility in future changes.

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