

Model of Effective Education Quality Management Based on the Introduction of Automated Systems

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Abstract – The problem of effective management of the educational process through the automation of activities is most relevant in educational institutions in terms of both improving the quality of education and optimizing basic processes in general. Within the framework of this scientific article, the authors calculate the effectiveness of educational activities using the example of the Grozny State Oil Technical University (GSOTU) using the automated score-rating system (SRS) and the selected main factors. A model of the effectiveness of education quality management is given, the ultimate goal of which is to form a “rating” of a student in an automated system that will control not only performance data, but also individual.

Keywords – higher education; basis factors; motivators; practice of management of the educational process; competencies; model of the effectiveness of the educational process; rating.

I. INTRODUCTION

Higher education in Russia, as well as throughout the world, has long gone beyond the general educational dogma. With the transition of Russia in 2003, the Bologna system has changed as the requirements for the student - bachelor, and faculty. Schools have shifted to new methods for evaluating and ranking training programs, and teachers have become increasingly stringent. A typical example of such a system was the British system of evaluation in higher education, a distinctive feature of which is the orientation of universities to the needs of the labor market. According to such a model, the quality of education received is reflected in the “diplomas and degrees” path. [9]

For more than ten years with the entry of Russia into a single educational space, the quality of education and the mechanisms for its improvement are at the center of attention both from the state and from the specialized authorities of the country's economy. [10]

In the work of Danilov D.A. the conclusions about the change in the approach to education summarized. Education has gone from classical understanding to a form of social practice - standards regulate the level of necessary knowledge and the form of organization of interaction with the teacher, sufficient

to obtain a specific trajectory of the degree of education. In modern Russia, education is still undergoing some form of renewal through the introduction of new innovative technologies. [11]

In addition, the institution of higher education itself has become regarded as a platform aimed at obtaining an optimal result that meets the requirements of consumers, meets the requirements of the market and allows them to take a leading position in the growing competition in the educational services market.

The demand in the education market has changed; the management system in a higher educational institution has undergone significant changes based on the introduction of information technologies. These innovative transformations include new management technologies such as a modular rating system of education, distance education, transition to computer-aided design of educational programs taking into account professional standards, effective use of online training systems for video conferences, webinars, etc.

The object of research in this article is the information-educational environment of the educational institution “Grozny State Oil Technical University named after Academician M. D. Millionshchikov” (GSOTU).

The subject of the research is the methods of rating ranking of the quality of education on the basis of the automated system “Point-rating system for assessing students' achievements” at the Institute of Applied Information Technologies of the GSOTU.

II. METHODS AND MATERIALS

An analysis of the theoretical and practical rationale for solving the problem is the effective management of computer-aided automation tools in the higher education system - shows that there is no systematic approach to the implementation of educational management technologies in this issue, which dictated the need for this research.

For the first time, the problem of university automation was touched upon by V.E. Kovalenko, A.V. Fedotov, was analyzed

by many scientific schools and the results were reported at seminars at the Research Institute of the Higher School of the Soviet Union in 1970-1980 [1]. At that time, typical automation programs covered only the largest universities of the USSR and the whole process of their implementation was carried out under the guidance of specially created commissions, whose extensive theoretical experience, however, has not lost relevance to this day [2]. In turn, the implementation process of such automated systems was carried out in stages and took a long time and a large amount of funds, since it was an area of practically untested factors in the management of educational systems.

The first stage is "patchwork" automation was the introduction of separate subsystems and components, completely platform incompatible with each other modules. The developed applications solved specific problems that require many hours of manual ore, but after implementation they required some operations before being put into operation.

The second stage is characterized by attempts to move from individual programs to integrable software. The possibilities of software to support several types of subsystems are being investigated, but due to the lack of suitable programming systems, this problem remains unsolved at this stage.

The third stage is corporate information systems (CIS) of the new generation. Here, the dominant concept is corporate governance - a system of relationships between co-founders, employers, the board of directors and the board, defined by the articles of association, regulations and official policies of the university.

Vivid examples of their implementation are the programs - the automated system "University", the system of management of the university "Sokrat", a wide range of proposals based on the Russian platform ERP- Galaktika (automation of the university: admissions office, dean's office, class schedules, etc.), "Parus", "Figaro", "KST M-3", as well as Western products R/3 SAP, Oracle, Axapta / Navision, Frontstep). KIS is today called information systems for a manager, which refers to products of the Business Intelligence class [3]. Of course, today leading universities in the field of information technology has already solved the above problems.

For example, the automated system "Electronic University" at the Moscow State Technical University n.a. N.E. Bauman has been introduced since 2009. The system incorporates many services - Student, Applicant, Lecturer, Employer, University departments, Organization of work with graduates, Rating of students for a semester. Developers of the automated system "Electronic University" received the award of the Government of the Russian Federation in the field of education in 2010. [4]

Of course, in practice, each university, taking into account its specific situations during the process of introducing automated systems, has mastered not all of the above steps, but may have even "stepped over" from the first to the third. In accordance with the real approaches to solving this problem, each higher education institution adopted its own Policy or Informatization Concept - a set of gradual procedures for automating the activities of the university, relating to all departments of the educational institution and employees.

These conceptual developments of practical implementation of university informatization systems made it possible to establish real positions for improving the quality of education by implementing the monitoring of basic educational indicators.

In 2015, the Grozny State Oil University adopted the "Program for the Strategic Development of the State Pedagogical State University" until 2025, in which the main objectives for the implementation of this concept were: "to develop and improve the quality management system at the university; ensuring the conduct of regular internal and external audits of the quality of educational programs, study of academic disciplines; certification of education quality management system" [5]. One of the proposed solutions to ensure the improvement of the quality management system of education is the Regulation on the system of organizing the control of knowledge, which regulates all the norms and rules for the systematic monitoring of students' educational achievements.

III. RESULTS

At the Grozny Oil Technical University, certification forms of students' current knowledge control have been introduced since 2006. Students pass in each academic semester two certification work (intermediate knowledge) for each discipline of the curriculum. But due to the fact that knowledge control systems were constantly improved, while the curricula and competencies of graduates changed many times, there was a need to solve the problem of the most "competent" knowledge control, which was the reason for the appearance of point-rating systems (PRS).

Competence - a dynamic combination of knowledge and skills and the ability to apply them to a successful professional activity. Competences can be formed and tested at a lecture, seminar, thematic conference, laboratory or practical training, course design, thesis design. With professional competencies more difficult, they force teachers to look for non-standard forms of classes: role-playing, round table, press conference, business game, brainstorming. In such classes, it is difficult to reduce the essence of the educational process to a simple transfer of evidence and information. The point-rating system not only most fully reflects the bachelor's acquisition of professional competencies in an educational program, but also helps to track the entire life cycle of a student's educational activity in the discipline and occupation.

In GSOTU the point-rating assessment of students' knowledge has been tested and accepted for implementation in the educational process since 2011. According to the Regulation on the PRS, which is the main regulatory document of the system implemented in GSOTU, the results of student's educational activities during the semester are estimated at 100 points and include monitoring of current activity and midterm certification, as well as the results of independent work and design and research activities. Based on the results of all types of control, a consolidated rating score is formed. Rating assessment is a quantitative indicator of the state of a student's educational activity, which allows to evaluate the degree of his achievements in all studied disciplines. Rating is expressed in points and at any point of the educational trajectory, it

represents the sum of the points received by the student as a result of passing the control tests. [6]

At the Institute of Applied Information Technologies of GSOTU, the task was to develop an automated scoring system for the student's current progress, to display these results in the electronic documentation of the dean's office and departments. In addition, it was necessary to solve the task of accompanying the PRS by organizing access to full information for all participants in this process. The information system "PRS" developed by the authors practically allowed to solve all the tasks. The system components integrated in this software solution regulate databases, starting from system administration - pre-registration of all participants, initialization of primary directories (recording the list of disciplines for each semester, etc.) and other administrative functions, ending with placing the results on WEB-portal [1].

Consider this process in more detail on the example of the formation of analytical reports on the results of certification. After conducting two milestone assessments during the semester, a summary report is submitted to the Department of Academic Affairs, which regulates such analytical data as discipline, reporting, and the dynamics of student scoring.

The department "Applied and Higher Mathematics" regulates the input and intermediate slice of students' knowledge: after entering the university, the "input" knowledge is checked, and during the semester - intermediate. Of course, initial knowledge is drawn up in the form of written tests, and intermediate ones can be tracked by the sum of points scored by the student during the semester.

In the complex formalization of the analytical unit in the PRS system, all the necessary requirements were fulfilled:

1) strict reduction of the Discipline to the Department as an object reflecting the quality of the work performed by the faculty, the level of students' knowledge;

2) bringing the Disciplines to the Teachers as a factor reflecting the level of specialist training. In case of discrepancy between the level of knowledge in readable disciplines, to regulate the certification of the teacher for knowledge of both theoretical and practical material;

3) automation of the overall student rating by entering data into a single repository in the form of a student's electronic portfolio. In correlation, the automated system "PRS" and the system "Portfolio" are integrated for subsequent interaction in the data warehouse.

On the basis of these tasks, it is required to determine the factors influencing the effectiveness of quality management in education, taking into account the requirements indicated. This occurs, first of all, by constructing algorithms based on basis factors and motivators. [7]

The basis factors are technologies of resource security - financial, material and technical, methodical, organizational support for the discipline. Accordingly, the connection of the basis factor with the motivators (professional growth, reward system) is described by a mathematical model — security should influence professional growth and be displayed by the reward system. Thanks to this relationship, it is possible to

achieve a constant motivation of the teaching staff to the continuous process of improving the professional level. Of course, to support the above algorithm, a description is given in detail of the software by which the efficient operation of the algorithm is achieved. It should be noted that there are many ways to display the dependence of some variables on others. The most common of these is the compilation of systems of equations. In our case, it is necessary to describe the dependence of the factors influencing the effectiveness of quality management in education.

The model of the effectiveness of education quality management can be represented as the following system of differential equations of the form (1):

$$\begin{aligned} \frac{dx}{dt} &= k \cdot x(t) + l \cdot y(t) + g(t) \\ \frac{dy}{dx} &= p \cdot x(t) + q \cdot y(t) + r \cdot z(t) + g(t) \\ \frac{dz}{dx} &= k \cdot x(t) + l \cdot z(t) + f(t) \\ \frac{dz}{dy} &= p \cdot x(t) + q \cdot z(t) + r \cdot y(t) + g(t), \end{aligned} \quad (1)$$

where x – financial security discipline;

t – reward system;

l – material and technical support of the discipline;

g – organizational support for the discipline;

k – methodical maintenance of discipline;

y – the motivation of the teaching staff to the continuous process of improving the professional level.

Thus, we have developed a model for the quality management of education in the framework of this scientific article. The dependent variable in the model [1.1.] is the motivation of the teaching staff to the continuous process of improving the professional level (variable y), depending on a number of basis factors. In turn, most of the factors are closely related to the reward system (variable t), which does not contradict not only mathematical, but also general logic. Based on our description of the model, we can conclude that this model quite correctly describes the issues analyzed in the article. [8]

In accordance with the adopted Strategic Development Plan in the GSOTU, it is necessary to implement the placement in the electronic portfolio of the results of educational, research, design and creative achievements. In this connection, the authors developed a regulatory document regulating the procedure for posting information on these materials, called the Regulation on the student's electronic portfolio. This WEB-repository usually contains a set of documents confirming the individual achievements of the student in various areas of activity.

At this stage, there is an analysis of the possibility of integrating the final results of the academic achievements of students from the PRS into the student's WEB-portfolio system for automating the display of the student's rating. This level of automation will allow you to more fully display the full range of student achievements in both academic and project-research

and social activities. A multifactorial analysis of the student's vocational training during the period of study also makes it possible to work out methods of stimulation, for example, in appointing higher and nominal scholarships. Based on the analytical expert monitoring systems of student achievement implemented in the educational process and the individual achievements of students, the mechanism of "performance management" was implemented, which requires active and continuous student learning throughout the semester.

IV. CONCLUSION.

The use of the above mechanisms in the practice of managing the educational process has increased the academic performance and quality of education by an average of 5% - 7% compared with the previous academic year. The audit of the certification and session each semester is reported at the Academic Council of the Institute of Applied Information Technologies and the University, analytical reports on which provide an opportunity to test new, competitive ideas of the effectiveness of professional activities of management personnel, educational activities of students.

As a solution to the above problems, the following forms of integrating the education process into a single set or system have been strengthened:

- development of a student's competitiveness competence for self-realization;
- effective use of information technology in the management of the educational process;
- increase the motivation of students, as a means of achieving professional competence.

Thus, in the framework of this scientific article, an analysis of the successful testing of the automated system "PRS" was conducted, during which the main factors affecting the quality of education management at the university were identified. The

authors developed and tested a mathematical model based on the means of differential calculus, which allowed to visually describe the effectiveness of the implementation of information systems for managing the educational process.

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