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## **MODERNIZATION OF THE UNIVERSAL COMPUTING PROGRAM ACCORDING TO THE METHOD OF IMPROVEMENT OF THE CALCULATION PROCEDURE FOR THE QUANTITATIVE ASSESSMENT OF THE QUALITY OF TRAINING PROVIDED IN INTERNATIONAL PROGRAMS**

**МОДЕРНІЗАЦІЯ УНІВЕРСАЛЬНОЇ ОБЧИСЛЮВАЛЬНОЇ ПРОГРАМИ З УРАХУВАННЯМ МЕТОДУ ВДОСКОНАЛЕННЯ РОЗРАХУНКУ КІЛЬКІСНОЇ ОЦІНКИ ЯКОСТІ ВИКЛАДАННЯ ЗА МІЖНАРОДНИМИ ПРОГРАМАМИ**

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**Abstract.** Providing timely and high-quality educational services for a foreign customer is a critical task determining the university's reputation in the international arena and, thus, subsequent international orders. In the conditions of competition in the global market of educational services, it is necessary to constantly confirm the high standards of the university. To significantly reduce the time of calculation, a universal computing program has been created. This program allows processing extensive data blocks with visualization of the results in the two-dimensional coordinate system. The results made it possible to make quick adjustments in the educational process in order to improve the quality of educational services to international customers. Also, due to implementation of this program in the working process of the Educational-Scientific Centre of International Cooperation of NUOS and obtained extensive results, there has been developed a method of improvement of the calculation procedure of the quantitative assessment of the quality of training provided to foreign students. This method is taken as a basis for modernization of the universal computing program for the quantitative assessment of the training quality.

**Keywords:** universal computing program; improvement of calculation procedure; quantitative assessment of the quality; fundamental approaches of project management; international educational program.

**Аннотация.** Для значительного сокращения времени на расчёты была создана универсальная вычислительная программа. Данная программа позволила обработать обширные блоки данных с визуализацией результатов в двухмерной системе координат. Полученные результаты дали возможность оперативно вносить коррективы в учебный процесс с целью повышения качества предоставляемых образовательных услуг международному заказчику. Также благодаря имплементации данной программы в рабочий процесс учебно-научного центра международного сотрудничества НУК и полученным массивам результатов был разработан метод совершенствования расчёта количественной оценки качества преподавания иностранным студентам. Этот метод лёг в основу модернизации универсальной вычислительной программы расчёта количественной оценки качества преподавания.

**Ключевые слова:** универсальная вычислительная программа; совершенствование расчёта; количественная оценка качества; принципиальные подходы управления проектами; международная образовательная программа.

**Анотація.** Для значного скорочення часу на розрахунки була створена універсальна обчислювальна програма. Дана програма дозволила обробити великі блоки даних з візуалізацією результатів у двомірній системі координат. Отримані результати дали можливість оперативно вносити корективи в навчальний процес з метою підвищення якості освітніх послуг міжнародному замовнику. Також завдяки імплементації даної програми в робочий процес навчально-наукового центру міжнародного співробітництва НУК і отриманим масивам результатів був розроблений метод вдосконалення розрахунку кількісної оцінки якості викладання іноземним студентам. Цей метод було по-

кладено в основу модернізації універсальної обчислювальної програми розрахунку кількісної оцінки якості викладання.

**Ключові слова:** універсальна обчислювальна програма; вдосконалення розрахунку; кількісна оцінка якості; принципи підходи управління проектами; міжнародна освітня програма.

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**Problem statement.** For Ukraine, becoming a full-fledged partner of the European Union and being taken seriously in the world arena is impossible without extensive integration of not only economic, but also cultural and educational factors.

The agreement on the association of Ukraine with the European Union, which was signed on June 27, 2014, entails introduction of European standards into many spheres of the state's functioning. In particular, it concerns the educational process. It is well-known that the standards of the Western world in education are rather high, which, in turn, implies an increase in the level of the Ukrainian education.

Globalization of the market of educational services causes the transformation of national education systems in many countries. This phenomenon is explicitly illustrated by such countries as the US, the UK, South Korea, countries of the Eastern Europe, and so on. As a result of globalization, the introduction and development of the Bologna process is the most important factor for Ukraine, as well as for other European countries, in reforming higher education in addition to systemic reforms [1].

On June 19, 1999, 29 Ministers of Education of the European countries signed the Bologna Declaration [2], which became the catalyst for development and modification of the ideas of the Sorbonne Declaration [3] about the European Higher Education Area. It promotes closer relations of European countries in the development and enhancement of their intellectual, social, scientific and technological potentials, as well as academic and cultural synergy.

An important factor for the prosperity of European universities is the academic mobility of students, as well as a high degree of autonomy in decision-making and rigorous international activity. Considering the European educational model, one should not ignore the factor of competition. Educational services of the Western world are tied to the market economy and follow a simple and stringent law of supply and demand. A profession that is not of interest for the labor market does not withstand competition, and the university is forced to downsize the corresponding specialty with all the ensuing consequences, such as staff dismissal, reduction of the training load, and so on. In fact, the ability to adapt to the constant changes of the modern world is the key to success of Western universities.

The officials of Ukrainian higher education institutions should keep in mind that by adopting European standards, they also accept the terms of healthy competition not only with each other, but also with European universities. And if the universities of the UK, France

and Germany are of little interest for most Ukrainian applicants because of the historical pricing conditions and other factors, the universities of such countries as Poland, Slovakia and the Czech Republic are quite attractive and affordable. As evidenced by the 2013 Human Development Report, the overall level of satisfaction with the educational system in these countries is higher than that in Ukraine [4].

Under the conditions of increasing competition in the sphere of education worldwide, the only way for a higher educational institution of Ukraine to function properly is to meet high criteria and world standards. And this can not be achieved without rigorous international activity aimed at the development of international educational programs.

Entering the international market of educational services, a Ukrainian university must meet the criteria set by the process of globalization. It is necessary to study the labor market in detail and determine the industries which demand highly skilled personnel in the country where the future partner resides. Having received the order for the training of specialists, every effort should be made to ensure the high quality of the educational services.

The Admiral Makarov National University of Shipbuilding implements quantitative assessment of the quality of training provided by individual lecturers to control the level of education quality. It is a basis for making personnel and organizational decisions.

**Latest research and publication analysis.** Project quality management includes all the activities related to general management functions. They define the quality policy, assignments and responsibilities, and implement them by such means as quality planning, monitoring and improvement within the framework of quality assurance [9].

The process of project quality management comprises three main elements: quality planning, quality assurance, and quality control. It is rather difficult to carry out an objective quantitative assessment of the lecturers' work with the help of conventional quality control methods. Many researchers point out the need for such an assessment, associating the activities aimed at motivating lecturers to a high level of performance with the university administration's ability to have an objective assessment of the lecturers' work at their disposal [10–14].

In the NUOS, it is suggested to regard the lecturer as a person who seeks to help the student to acquire the necessary knowledge and skills implicated by the educational standard. Based on this approach, there has been accepted a calculation procedure for the quantitative assessment of the quality of training [5]. This calculation procedure has already been used to assess the educa-

tional process within Ukraine, but it is the first time that it is implemented in assessing international educational programs. Literary sources contain no data on the existence of a universal computing program for the quantitative assessment of the quality of training. Therefore, such a program has been developed to simplify this procedure [18]. Due to its implementation in the working process of the Educational and Scientific Center for International Cooperation of the NUOS and the results obtained [15–17], there has been developed a method for improving the quantitative assessment of the quality of training provided to foreign students.

**THE ARTICLE AIM** is to modernize the universal computing program on the basis of the method for improvement of the calculating procedure of the quantitative assessment of the quality of training.

**Basic material.** The Admiral Makarov National University of Shipbuilding (Mykolaiv) successfully implements a number of educational programs in collaboration with foreign partners [8].

A key factor in improving the methodology for the quantitative calculation of the quality of training in international programs is how foreign students assess the lecturers' work. The assessment is carried out by means of a questionnaire survey, resulting in assigning the lecturer a score from 0 to 100.

The results of the questionnaires serve as a basis for adjusting the calculation procedure of the quantitative assessment of the quality of training.

Variance of the lecturers' rating is taken into account via dispersion of the average score given by the students in the questionnaire to the  $k$ -th lecturer. The dispersion is calculated according to the formula for the ordered series (ungrouped data) for each subject:

$$\sigma_s^2 = \frac{\sum_1^S (X_s - X_{ks})^2}{S};$$

where  $X_s$  is the average score given by students to the  $k$ -th lecturer of the  $j$ -th subject for the observed period;  $X_{ks}$  is the score given by the  $i$ -th student to the  $k$ -th lecturer for the  $j$ -th subject for the observed period;  $S$  is the number of students who studied the  $j$ -th subject with the training provided by the  $k$ -th lecturer over the observed period.

The relative indicator  $\Omega_s$  quantitatively characterizes the quality of the  $k$ -th lecturer's work as a result of the student questionnaire survey in all the subjects. It is calculated with the use of the formula of reciprocal to the quadratic coefficient of variation:

$$\Omega_s = \frac{\overline{X_s}}{\sigma_s}.$$

The rating score is calculated as a result of the student questionnaire survey as for the quality of training provided by the  $k$ -th lecturer with the help of the formula below:

$$R_s = \frac{\Omega_s}{\sum_1^n \Omega_s}.$$

$n$  is the number of lecturers of the educational institution (or its structural unit) in the observed period.

Therefore, the general rating score of the quality of the  $k$ -th lecturer's work at university  $R_{ks}$  shall be calculated from the arithmetic mean of the lecturer's final assessment and the average rating score obtained from the student questionnaire survey over the observed period:

$$R_{ks} = \frac{R_k + R_s}{2}.$$

The total of the rating scores of all the lecturers of the educational institution (or its structural unit) for the observed period is equal to unity.

The main array of the universal computing program contains two blocks for calculation of the rating according to the student assessment. The initial block for calculating the average score is suitable for assessing both lecturers and assessing students, so it remains unchanged.

The first section of calculation of the rating  $R_s$  according to the student assessment is as follows:

```
ds1 = app.s1EditField.Value;
ds2 = app.s2EditField.Value;
ds3 = app.s3EditField.Value;
ds4 = app.s4EditField.Value;
ds5 = app.s5EditField.Value;
ds6 = app.s6EditField.Value;
ds7 = app.s7EditField.Value;
ds8 = app.s8EditField.Value;
ds9 = app.s9EditField.Value;
ds10 = app.s10EditField.Value;
Rs1 = ds1/(ds1+ds2+ds3+ds4+ds5+ds6+ds7+ds8+
+ds9+ds10);
app.Rs1EditField.Value = Rs1;
Rs2 = ds2/(ds1+ds2+ds3+ds4+ds5+ds6+ds7+ds8+
+ds9+ds10);
app.Rs2EditField.Value = Rs2;
Rs3 = ds3/(ds1+ds2+ds3+ds4+ds5+ds6+ds7+ds8+
+ds9+ds10);
app.Rs3EditField.Value = Rs3;
Rs4 = ds4/(ds1+ds2+ds3+ds4+ds5+ds6+ds7+ds8+
+ds9+ds10);
app.Rs4EditField.Value = Rs4;
Rs5 = ds5/(ds1+ds2+ds3+ds4+ds5+ds6+ds7+ds8+
+ds9+ds10);
app.Rs5EditField.Value = Rs5;
Rs6 = ds6/(ds1+ds2+ds3+ds4+ds5+ds6+ds7+ds8+
+ds9+ds10);
app.Rs6EditField.Value = Rs6;
Rs7 = ds7/(ds1+ds2+ds3+ds4+ds5+ds6+ds7+ds8+
+ds9+ds10);
app.Rs7EditField.Value = Rs7;
Rs8 = ds8/(ds1+ds2+ds3+ds4+ds5+ds6+ds7+ds8+
+ds9+ds10);
app.Rs8EditField.Value = Rs8;
```

```

Rs9 = ds9/(ds1+ds2+ds3+ds4+ds5+ds6+ds7+ds8+
+ds9+ds10);
app.Rs9EditField.Value = Rs9;
Rs10 = ds10/(ds1+ds2+ds3+ds4+ds5+ds6+ds7+
+ds8+ds9+ds10);
app.Rs10EditField.Value = Rs10;
if ds2 == 0 & ds3 == 0 & ds4 == 0 & ds5 == 0 & ds6
== 0 & ds7 == 0 & ds8 == 0 & ds9 == 0 & ds10 == 0
plot(app.UIAxes2,[1],[Rs1]);
hold(app.UIAxes2);
scatter(app.UIAxes2,[1],[Rs1]);
hold(app.UIAxes2);
elseif ds3 == 0 & ds4 == 0 & ds5 == 0 & ds6 ==
==0 & ds7 == 0 & ds8 == 0 & ds9 == 0 & ds10 == 0
plot(app.UIAxes2,[1 2],[Rs1 Rs2]);
hold(app.UIAxes2);
scatter(app.UIAxes2,[1 2],[Rs1 Rs2]);
hold(app.UIAxes2);
elseif ds4 == 0 & ds5 == 0 & ds6 == 0 & ds7 ==
==0 & ds8 == 0 & ds9 == 0 & ds10 == 0
plot(app.UIAxes2,[1 2 3],[Rs1 Rs2 Rs3]);
hold(app.UIAxes2);
scatter(app.UIAxes2,[1 2 3],[Rs1 Rs2 Rs3]);
hold(app.UIAxes2);
elseif ds5 == 0 & ds6 == 0 & ds7 == 0 & ds8 ==
==0 & ds9 == 0 & ds10 == 0
plot(app.UIAxes2,[1 2 3 4],[Rs1 Rs2 Rs3 Rs4]);
hold(app.UIAxes2);
scatter(app.UIAxes2,[1 2 3 4],[Rs1 Rs2 Rs3 Rs4]);
hold(app.UIAxes2);
elseif ds6 == 0 & ds7 == 0 & ds8 == 0 & ds9 ==
==0 & ds10 == 0
plot(app.UIAxes2,[1 2 3 4 5],[Rs1 Rs2 Rs3 Rs4
Rs5]);
hold(app.UIAxes2);
scatter(app.UIAxes2,[1 2 3 4 5],[Rs1 Rs2 Rs3 Rs4
Rs5]);
hold(app.UIAxes2);
elseif ds7 == 0 & ds8 == 0 & ds9 == 0 & ds10 == 0
plot(app.UIAxes2,[1 2 3 4 5 6],[Rs1 Rs2 Rs3 Rs4
Rs5 Rs6]);
hold(app.UIAxes2);
scatter(app.UIAxes2,[1 2 3 4 5 6],[Rs1 Rs2 Rs3 Rs4
Rs5 Rs6]);
hold(app.UIAxes2);
elseif ds8 == 0 & ds9 == 0 & ds10 == 0
plot(app.UIAxes2,[1 2 3 4 5 6 7],[Rs1 Rs2 Rs3 Rs4
Rs5 Rs6 Rs7]);
hold(app.UIAxes2);
scatter(app.UIAxes2,[1 2 3 4 5 6 7],[Rs1 Rs2 Rs3
Rs4 Rs5 Rs6 Rs7]);
hold(app.UIAxes2);
elseif ds9 == 0 & ds10 == 0
plot(app.UIAxes2,[1 2 3 4 5 6 7 8],[Rs1 Rs2 Rs3 Rs4
Rs5 Rs6 Rs7 Rs8]);

```

```

hold(app.UIAxes2);
scatter(app.UIAxes2,[1 2 3 4 5 6 7 8],[Rs1 Rs2 Rs3
Rs4 Rs5 Rs6 Rs7 Rs8]);
hold(app.UIAxes2);
elseif ds10 == 0
plot(app.UIAxes2,[1 2 3 4 5 6 7 8 9],[Rs1 Rs2 Rs3
Rs4 Rs5 Rs6 Rs7 Rs8 Rs9]);
hold(app.UIAxes2);
scatter(app.UIAxes2,[1 2 3 4 5 6 7 8 9],[Rs1 Rs2 Rs3
Rs4 Rs5 Rs6 Rs7 Rs8 Rs9]);
hold(app.UIAxes2);
else
plot(app.UIAxes2,[1 2 3 4 5 6 7 8 9 10],[Rs1 Rs2
Rs3 Rs4 Rs5 Rs6 Rs7 Rs8 Rs9 Rs10]);
hold(app.UIAxes2);
scatter(app.UIAxes2,[1 2 3 4 5 6 7 8 9 10],[Rs1 Rs2
Rs3 Rs4 Rs5 Rs6 Rs7 Rs8 Rs9 Rs10]);
hold(app.UIAxes2);
end

```

The second section of calculation of the general rating  $R_{ks}$  is as follows:

```

Rks1 = (R1+Rs1)/2;
Rks2 = (R2+Rs2)/2;
Rks3 = (R3+Rs3)/2;
Rks4 = (R4+Rs4)/2;
Rks5 = (R5+Rs5)/2;
Rks6 = (R6+Rs6)/2;
Rks7 = (R7+Rs7)/2;
Rks8 = (R8+Rs8)/2;
Rks9 = (R9+Rs9)/2;
Rks10 = (R10+Rs10)/2;
app.Rks1EditField.Value = Rks1;
app.Rks2EditField.Value = Rks2;
app.Rks3EditField.Value = Rks3;
app.Rks4EditField.Value = Rks4;
app.Rks5EditField.Value = Rks5;
app.Rks6EditField.Value = Rks6;
app.Rks7EditField.Value = Rks7;
app.Rks8EditField.Value = Rks8;
app.Rks9EditField.Value = Rks9;
app.Rks10EditField.Value = Rks10;
plot(app.UIAxes2,[1 2 3 4 5 6 7 8 9 10],[Rks1 Rks2
Rks3 Rks4 Rks5 Rks6 Rks7 Rks8 Rks9 Rks10]);
hold(app.UIAxes2);
scatter(app.UIAxes2,[1 2 3 4 5 6 7 8 9 10],[Rks1
Rks2 Rks3 Rks4 Rks5 Rks6 Rks7 Rks8 Rks9 Rks10]);
hold(app.UIAxes2);

```

As a result, there was obtained a modernized universal computing program for the quantitative assessment of the quality of training (Fig. 1). It can be used both for the classical calculation based on the results of the lecturer's final assessment and for the suggested improved calculation, including the lecturer's final assessment and the students' assessment of the lecturer's work.

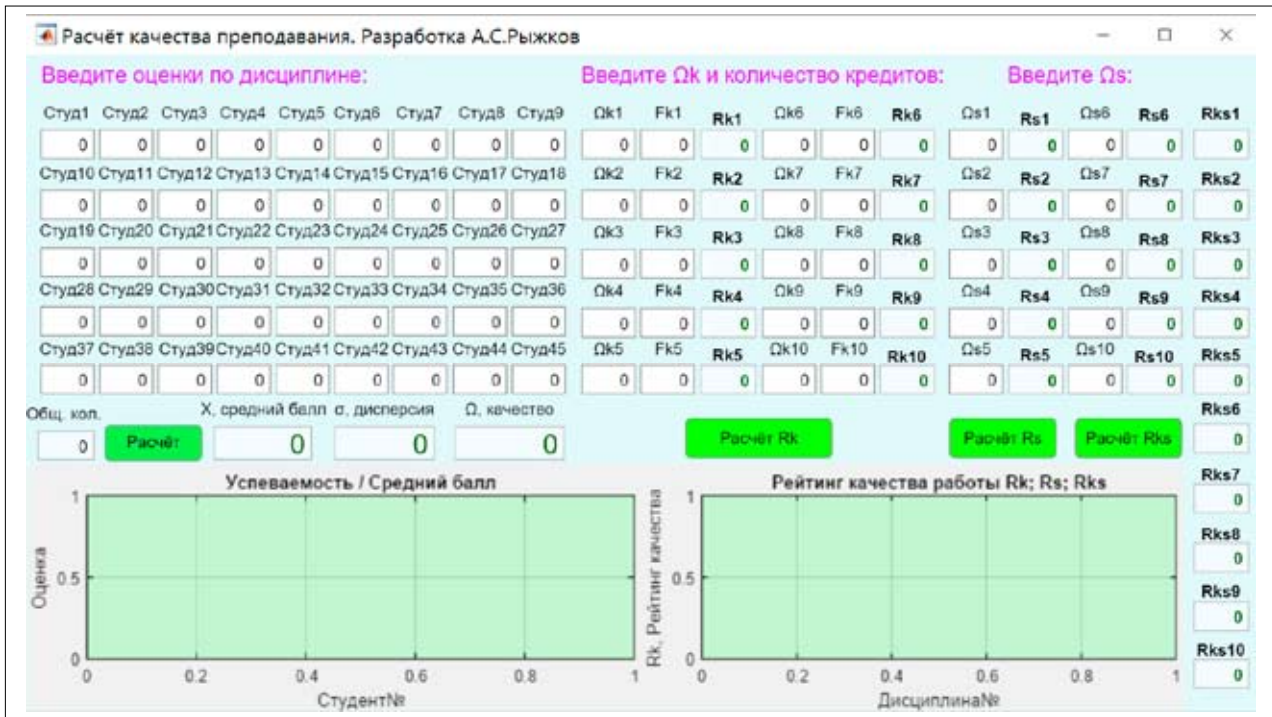


Fig. 1. Interface of the modernized universal computing program for the quantitative assessment of the quality of training

**CONCLUSIONS.** There has been a method proposed for improvement of the calculation procedure for the quantitative assessment of the quality of training. It was taken as a basis for modernization of the universal computing program.

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