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QUANTITATIVE INDICATORS OF STUDENT'S LEARNING SUCCESS IN HIGH SCHOOL

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ABSTRACT

The article provides a definition of the qualimetric assessment of a particular student to determine his degree of closeness to the "ideal" student. The Delphi method is used as one of the options for expert assessment. The educational trajectory of the student during the period of study is analyzed. A comparative analysis of the graphs for determining the qualimetric assessment during the semester has been carried out. The conclusions of the statistical processing of the results of continuous monitoring are given.

Keywords: Qualimetric assessment, Delphi method, educational trajectory, property tree.

INTRODUCTION

The educational process at university is a complex system consisting of a large number of interrelated components that influence on the quality of education.

The model of the system of organization of the educational process should illustrate dynamics of indicators of the educational system, interpret statistical data, predict development, find out the impact of decisions made for future development. One of the most important conditions for modeling the educational process is the creation of relationships and mutual influence between student and teaching party.

Pedagogical qualimetry is connected directly with the concept of quality of education, which makes it possible to quantify all components of the pedagogical process.

The level of knowledge of the problem
An extensive scientific foundation has been accumulated in foreign pedagogy, which creates prerequisites for determining quantitative measuring to ensure monitoring of the quality of education: philosophical and methodological foundations of educational qualitology have been developed (Potashnik MM, Subetto AI, etc.), [1,2] criteria for assessing the quality of education are highlighted (Gershunsky B.S., Potashkin M.M. and others), [3,2] assessing the quality of education (V. Guzeev), [5] use of statistical methods in pedagogy is described (L. Itelson B., Rabunsky E.S. and others) [7,6].
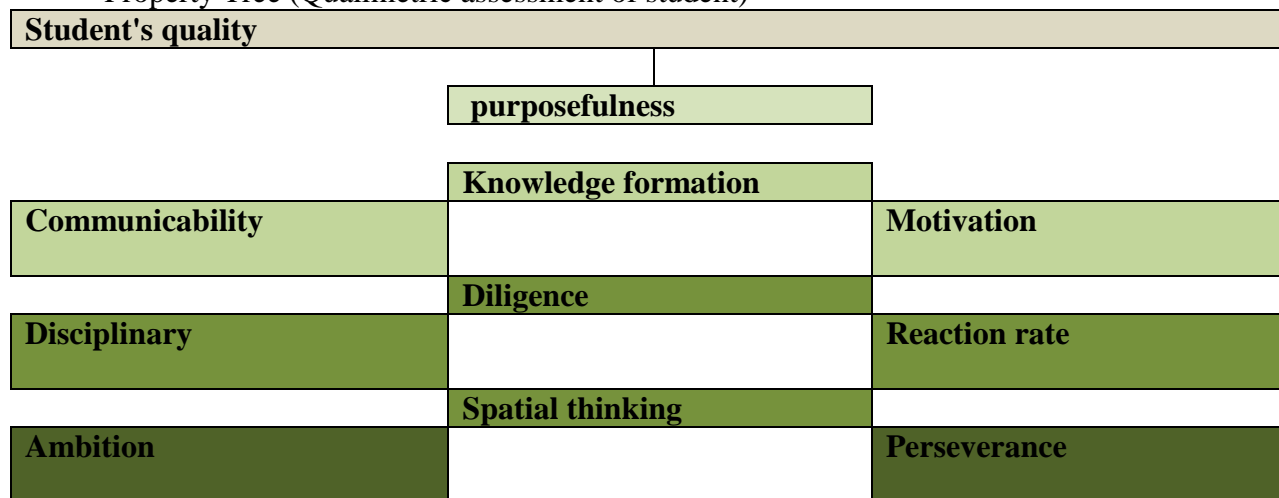
However, in the above literature there are no methods that give a qualimetric assessment of a particular student and the dynamics of his change during the period of study.

The aim of the article is to develop a qualimetric assessment of a particular student during the academic semester.

Main part

One of the methods of qualimetry is the construction of a property tree. We examine a particular student with a complex of various properties, both simple and complicated, belonging to different scales.

Property Tree (Qualimetric assessment of student)

Student's quality

	purposefulness	

	Knowledge formation	
Communicability		Motivation

	Diligence	
Disciplinary		Reaction rate

	Spatial thinking	
Ambition		Perseverance

10 properties were selected from a variety of other properties as more related to the final estimate. Each property is assigned a numeric value. With this approach, some academic group turns out to be a Pareto-optimal set, where each member is better than the other in one of the properties, but worse in the other. [7]

Mattrix is formed:

Table.1 Matrix

	q_1	q_2	q_3	q_4	q_5	q_6	q_7	q_8	q_9	q_{10}	$\sum_{1}^{10} q_i$
a_1											
...											
a_n											$\sum_{1}^{10} q_i$

where $0 \leq \leq 1$ is the numerical value of the property determined by the method of expert assessments.

n is the number of students in a group.

It is assumed that all properties can be projected onto a certain unified scale and evaluated with a certain number. At the next step, an "ideal" student is formed, for which all 10 properties take the value 1 and the sum of the properties is 10.

For each student, the Euclidean distance to the "ideal" student is calculated,

$$r_i = \pm \left[\left(10 - \sum_{1}^{10} r_i \right)^2 \right]^{\frac{1}{2}}$$

which determines the qualimetric assessment. In this case, the assessment indicates the state of the properties of the student at a certain time interval and is of a static nature.

However, it is obvious that all properties are not invariants and change over time, then the assessment r_i takes a dynamic character and serves as the basis for determining the student's educational trajectory.

We will examine a particular student, A.M., whose qualities above were determined by Delphi method.

In the table we will give a qualimetric assessment of student properties for the first month of study.

Table 2 First month

Purposefulness	0,9
Knowledge formation	0,85
Communicability	0,7
Motivation	1
Diligence	1
Disciplinary	1
Reaction rate	0,9
Spatial thinking	0,8
Ambition	0,8
Perseverance	1

We will analyze all the qualities of the particular student.

Stable qualities are related to manifestations of character, that is, perseverance, ambition, discipline, and interpersonal skills.

Qualities related to the qualities of the psyche, that is, spatial thinking and reaction rate may vary with the lapse of time.

The formation of knowledge is a dynamic indicator and changes over time.
Motivation as a manifestation of individual personality traits may also change under the influence of external factors.

The desire to get a higher education may result disappointment in the organization of the educational process of a particular university. Such cases have been in practice of the author. We will calculate the qualimetric assessment of the student A.M. for the first month of study.

$$r_i = \pm \left[\left(10 - \sum_{1}^{10} r_i \right)^2 \right]^{\frac{1}{2}}$$

r_i=10-0,9-0,85-0,7-1-1-1-0,9-0,8-0,8-1=1,05

for the same student A.M. qualimetric assessment for the second month of study

Table 3. Second month

Purposefulness	0,9
Knowledge formation	0,8
Communicability	0,7
Motivation	1
Diligence	1
Disciplinary	1
Reaction rate	0,9
Spatial thinking	0,9
Ambition	0,6
Perseverance	1

r_i=10-0,9-0,8-0,7-1-1-1-0,9-0,9-0,6-1=1,2
qualimetric assessment for the third month of study

Table 4. Third month

Purposefulness	1
Knowledge formation	0,75
Communicability	0,7
Motivation	1
Diligence	1
Disciplinary	1
Reaction rate	0,9
Spatial thinking	0,9
Ambition	0,5
Perseverance	1

r_i=10-1-0,75-0,7-1-1-1-0,9-0,9-0,5-1=1,25

qualimetric assessment for the forth month of study

Table 5. Forth month

Purposefulness	1
Knowledge formation	0,7
Communicability	0,7
Motivation	1
Diligence	1
Disciplinary	1
Reaction rate	0,8
Spatial thinking	0,9
Ambition	0,7
Perseverance	1

r_i=10-1-0,7-0,7-1-1-1-0,8-0,9-0,7-1=1,2

qualimetric assessment for the fifth month of study

Table 6. Fifth month

Purposefulness	1
Knowledge formation	0,7
Communicability	0,7
Motivation	1
Diligence	1
Disciplinary	1
Reaction rate	0,8
Spatial thinking	0,9
Ambition	0,7
Perseverance	1

r_i=10-1-0,7-0,7-1-1-1-0,8-0,9-0,7-1=1,2

qualimetric assessment for the sixth month of study

Table 7. Sixth month

Purposefulness	1
Knowledge formation	0,7
Communicability	0,7
Motivation	1
Diligence	1
Disciplinary	1
Reaction rate	0,8
Spatial thinking	0,9
Ambition	0,7
Perseverance	0,8

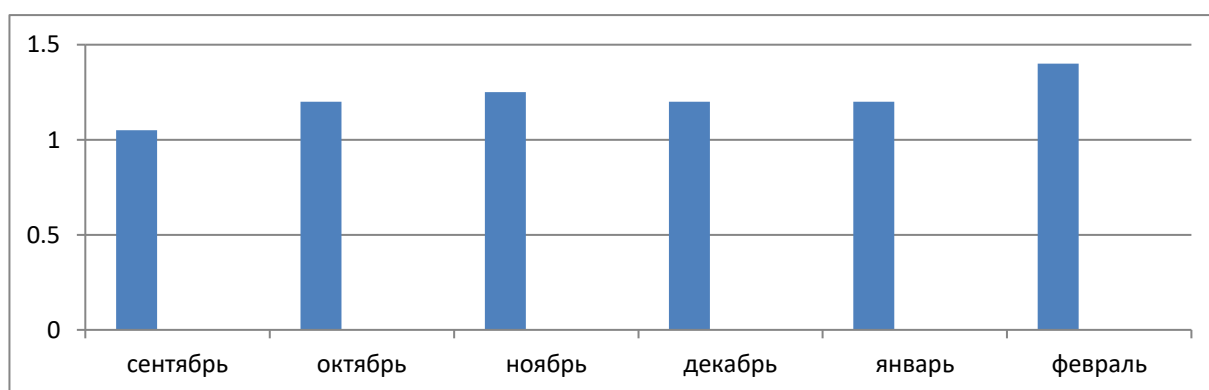r_i=10-1-0,7-0,7-1-1-1-0,8-0,9-0,7-0,8=1,4

Diagram. Educational trajectory of the student

The graph shows that closest to the "ideal" student A.M. was at the beginning of training, and farthest at the end of the semester. According to tables 1,2,3,4,5,6 it is clear that such qualities as motivation, discipline, diligence, perseverance and interpersonal skills did not change during the semester.

Such qualities as knowledge formation, reaction rate and ambition have changed. As the volume of knowledge increased, the overall knowledge formation decreased over time, as gaps appeared in the assimilation of topics difficult to understand.

At the same time, ambitiousness rates were decreasing. Such schedules were compiled for each student of the academic group and conclusions were drawn about the qualimetric assessment of each particular student.

During the semester, students undergo continuous certification - written assignments, oral questioning, problem solving, essay defense and computer testing.

Grades for each certification is determined by the student's rating.

We note an interesting fact - regardless of the type of control, the distribution of students' grades invariably obeys normal law.

Processing the results of the certification of more than 2,300 students, starting in 2011, using mathematical statistics methods made it possible to draw some conclusions.

Only 20% of selected students experienced a direct correlation and linear relationship between the estimates obtained for different types of controls. The rest of the selected students did not show the linear relationship between the estimates, and in 15% of cases an inverse correlation was observed. For each group of students an integral index was calculated for a specific type of control. [8]

In the case when the indicator was below the threshold value, i.e. minimum satisfactory assessment, it was necessary to state the fact of poor quality of students' knowledge. The relationship between the factors mentioned above was also determined by well-known methods of Q-Rosenbaum U — Mann-Whitney's criterion and etc. [9] The "weight" of each factor was determined as a result of applying the method of expert assessments, where students and teachers themselves acted as experts.

CONCLUSION

Experience shows that the final rating and qualimetric ratings positively correlate with each other. The educational trajectory of a particular student during the semester allows us to draw conclusions about how the properties of the student change over the period of study. Such monitoring serves as the basis for the management of the educational process during the semester.

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