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STATISTICAL APPROACH TO ESTIMATING OF EDUCATIONAL PROCESSABILITY

The article presents a model of analysis, allowing on the base of statistical methods to define the degree of educational processability. Methods conform to the requirements of ISO 9001-2009 "Quality management systems " and allows to manage efficiency of technologies of teaching and control of knowledge.

Keywords. Workability of the educational process, educational technology, statistical significance, quality management.

The problem of education quality is one of the central in the contemporary educational policy and science because it is associated with the solution of complex tasks, aimed at personal development with the high moral aspirations and motives to the highly professional work.In pedagogical theory and practice is increasinglyrecognized, that ignoring or downplaying the role in the educational process of any item or content of education causes enormous damage to the interests not only of the individual, but also the whole society.However, the educational process is a major component in the education system. The resultant side of the educational process is complicated personal-special information product in the form of education level.

The concept of education quality is inextricably linked with the concept of educational technology.In the documents of the UNESCO educational technology is viewed as a systematic method for creating, applying, and determine the total educational process of teaching and learning with regard to technical, human resources and their interactions.

It is impossible to drive a car, if the car is not steered by a wheel. Similarly, the presence of technology in the educational process is certainly primary in relation to the management of its quality and not obvious in any particular case. In this sense, the presence of technology is a necessary condition for the realization of any of the activities in the framework of the quality management system and defines the goal of this research to build and test system for the quantitative analysis of the educational processability as necessary prerequisites for the management of its quality.

Analysis technology

We will assume that the educational processability is its complete manageability. In other words, the presence of educational technology detected and determined through the predictability of the results.

During a semester at the International University "MITSO" arranged intermediate control tests of students' knowledge in the form of two certifications and one Director Test (DT). This monitoring gives us a detailed, objective and scaled data, suitable for in-depth analysis of various aspects of the quality of education.

ISO 9000 Quality Management System highlighted the role of statistical methods of data analysis. Technical Report ISO/TR 10017 tells: «Statistical techniques can help to measure, describe, analyze, interpret and model such variability, even with a relatively limited amount of data. Statistical analysis of such data may provide a better understanding of the nature, extent and causes of variability. This could help to solve and even prevent problems that could result from such variability».

Moving in line with the requirements of the standards, define the upper limit of the necessary conditions, which gives grounds to assert the existence of educational technology, as follows: the performance curve during the semester, with each subsequent trial should be parallel shift up (curves 1,2 in Fig.1).

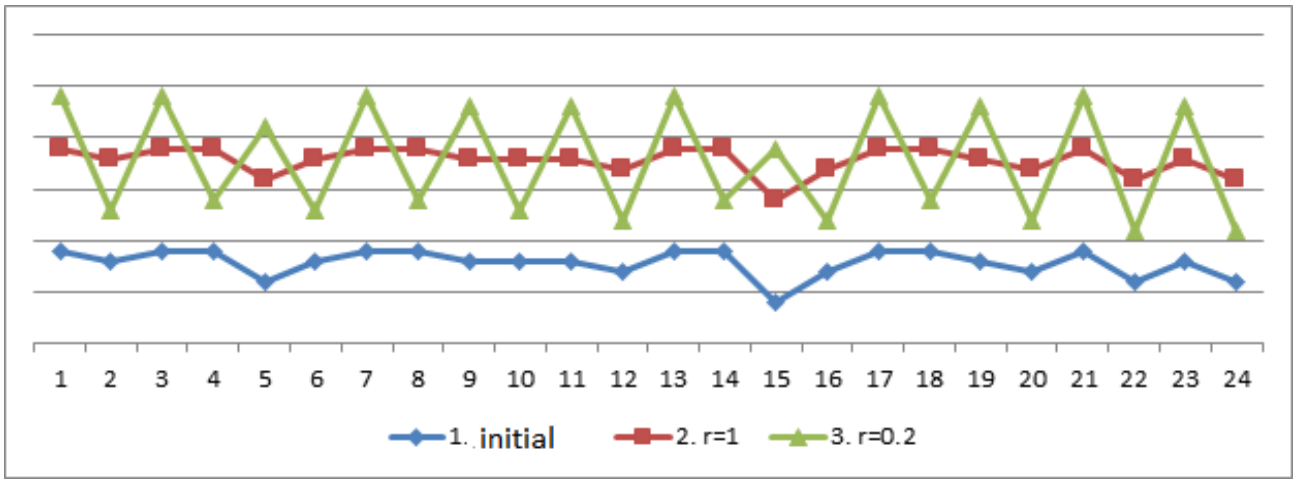

Fig. 1.Performance curves (spaced out roughly. Under the same growth average grade, the situation with processability of curves 2 and 3 significantly different)

Indeed, it is logical to see the same increase academic achievement for all students immersed in ***technology*** educational process, and, on the other hand, you can ***certainly argue about the absence*** of any technology, if the increments are unpredictable (curves 1,3). Thus, we proceed from the situation ***definitely incompatible*** with technological process, and in this sense the above conditions are necessary.

Proceed to formalizing conditions.

Parallel shift of the curve is characterized by the fact that, knowing the value of one point of the shifted curve, we can definitely predict the values of all other points on the original values. The statistics in this case indicate the presence of correlation between two variables with a correlation coefficient equal to one. Working with interval scales, we will use the Pearson correlation coefficient***r***, indicates a measure of linear dependence between variables. Values of the correlation coefficient will be interpreted in accordance with generally accepted interpretation given in the table below.

Value of *r*	**Interpretation**
up to 0.2	A very weak correlation
up to 0.5	Weak correlation
up to 0.7	The average correlation
up to 0.9	High correlation
more than 0.9	Very high correlation

To determine the direction and magnitude of the shift performancecurve will use the difference in adjacent sections of its average value in the students' group.

Thus, going from a graphical language to the language of statistical analysis, reformulate the conditions as follows:

1. The Pearson correlation coefficient, of neighboring performance sets is close to the unit;
2. Follow average grade ***not less than*** the previous one;
3. The results are statistically significant.

Stay on the third condition, because its failure is not possible to interpret the results more widely than a special case of the study group's life. Our task is to determine to what extent these results ***are based on internal factors*** of the educational process, are systematic and will appear in the future.

To summarize or generalize results, data must be subjected to a series of statistically valid procedures. First, check for the normality of the frequency distribution (Kolmogorov-Smirnoff test). This important test determines the choice of the next research tool. When the distribution is normal we conduct a t-test for paired samples (p=0.05), otherwise non-parametric Wilcoxon test [1] for sets "certification - DT and DT - exam". Figure 2 shows a diagram of generalization in IDEF3 notation.

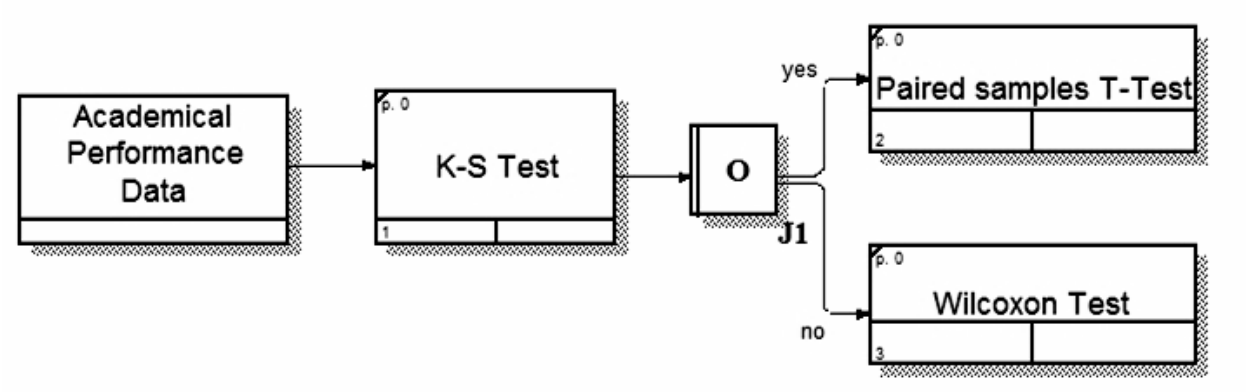

Fig. 2. Theschemeofdatageneralization

To talk about the change in the averagegrade, as well as about the value of the correlation coefficient, we will only in the case of obtaining a statistically significant result. Only this gives us reason to believe that the change in achievements occurred systematically, under the influence of factors that facilitate the educational process.

Figure 3 as an example, presents a screenshot of the results of processing the pairs of values of "DT-exam", obtained in SPSS after a positive outcome of the test for normality of the distribution.

PairedSamplesStatistics

		Mean	N	Std. Deviation	Std. ErrorMean
Pair 1	DT	8,2105	19	,71328	,16364
	exam	8,5263	19	,96427	,22122

PairedSamplesCorrelations

		N	Correlation	Sig.
Pair 1	DT& exam	19	,718	,001

PairedSamplesTest

		PairedDifferences					t	df	Sig.(2-tailed)
		Mean	Std. Deviation	Std. Error-Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	DT - exam	-,31579	,67104	,1539	-,63922	,00764	-2,05	18	,050

Fig. 3. The result of processing a couple sets of achievements

As we can see, these data reveal a high (0.718) significant (0.001) correlation and positive shift enough high average grade (8.2–8.5) the statistical significance of a result (two-tailed significance = 0.05).

Consider and comment on four possible outcomes of data processing, depending on the implementation of the formulated conditions.

1. Runs the first two conditions (the third is in any way and is not discussed)-there is a strong case for the existence of educational technology in the process (semester, discipline, teacher). See 1.2 curves in Figure 1.

2. Runs only the condition 1 – at first glance, we have a systematic decrease in performance. It can meet in a pair of "certification- DT" because of the higher requirements to the Director's control. However, the presence of a systematization, in our opinion, makes this outcome is preferable to the next.

3. Runs only condition 2 - the technology is not visible, but a progress is visible. (Probably created common to all favorable conditions for study and not more). See curves of 1,3.

4. The two conditions are not met, there is a fear of losing control of the process (positive test for ***lack of effect of processing***).

Analyzed the pairs of successive performance sets “certification” – DT and “DT – exam” in the fourgroups of the 5th year students in 22 one-semester educational processes Gomel branch International University “MITSO”.

One of the goals of the study was to assess the adequacy and sensitivity of the approach. The inability for obvious reasons to perform the model experiment was compensated in our case by significant factual material and repeated nature of the measurements.

In general, it should be noted a high degree of reliability of the results:

1. All four possible outcomes occurred;

2. In 86 % of cases technology, detected in first pair of performance sets, it was found in the second;

3. In 100 % of cases there was evidence that the level of technology of the educational process provided by the teacher, does not depend on the studied group.

In other words, the technique sees educational technology, if it exists, and is uniquely determines its absence.

Summarizing, we note the following:

1. Developed and successfully tested in the Gomel branch of the International University “MITSO” system for estimating of educational process abilitybased on rigorous statistical methods.

2. The system allows on the base of the current grades analysis perform the corrective and preventive actions in the framework of the quality management system.

3. The system is simple, provides objective results and can be recommended for use in the education system.

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СТАТИСТИЧНИЙ ПІДХІД ДО ОЦІНКИ ТЕХНОЛОГІЧНОСТІ ОСВІТНЬОГО ПРОЦЕСУ

Резюме. *У статті розглянуто модель аналізу, що дозволяє на основі статистичних методів визначити ступінь технологічності навчального процесу. Методика відповідає вимогам СТБ ISO 9001-2009 «Системи менеджменту якості» і дозволяє управляти ефективністю технологій навчання і контролю знань.*

Ключові слова. Технологічність освітнього процесу, освітня технологія, статистична значимість, управління якістю.

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СТАТИСТИЧЕСКИЙ ПОДХОД К ОЦЕНКЕ ТЕХНОЛОГИЧНОСТИ ОБРАЗОВАТЕЛЬНОГО ПРОЦЕССА

Резюме. *В статье рассмотрена модель анализа, позволяющего на основе статистических методов определить степень технологичности учебного процесса. Методика соответствует требованиям СТБ ISO 9001-2009 «Системы менеджмента качества» и позволяет управлять эффективностью технологий обучения и контроля знаний.*

Ключевые слова. Технологичность образовательного процесса, образовательная технология, статистическая значимость, управление качеством.