ИНФОРМАЦИОННЫЕ ТЕХНОЛОГИИ В ОБРАЗОВАНИИ

COMPUTER ANOVA OF QUALITY OF RESULTS OF HIGHER MATHEMATICS E-LEARNING

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КОМПЬЮТЕРНЫЙ ДИСПЕРСИОННЫЙ АНАЛИЗ КАЧЕСТВА РЕЗУЛЬТАТОВ ЭЛЕКТРОННОГО ОБУЧЕНИЯ ВЫСШЕЙ МАТЕМАТИКИ

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В данной работе проведен статистический анализ результатов оценивания образовательных показателей на примере студентов института электронного обучения Томского Политехнического университета. На базе проведенного дисперсионного анализа проведена кластеризация 8 групп студентов.

Дистанционные образовательные технологии, электронное обучение, дисперсионный анализ, кластеризация, уровень значимости.

According to [1], the main directions of improvement of modern correspondence education are innovative forms of learning (electronic and remote), improving the quality of students by introducing new technologies and training, quality assurance of learning outcomes and knowledge of students. In this work under the control of the quality of learning outcomes (as in [2-3]), the statistical analysis of the results of evaluation of knowledge in higher mathematics for the 2nd semester (differential calculus) of 170 students (8 teams of the correspondence courses) using distance technologies. Analysis was carried out in 2 indicators: IDH – total score for the performance of 4 individual homework assignments during the semester (maximum 60 points); EX- scores obtained by semester exam (maximum 40 points). For ease of comparison, all computing numerical data are given to a single 5-point scale. Thus created in the MS Excel database is further used in the package Statistica computer for statistical analysis.

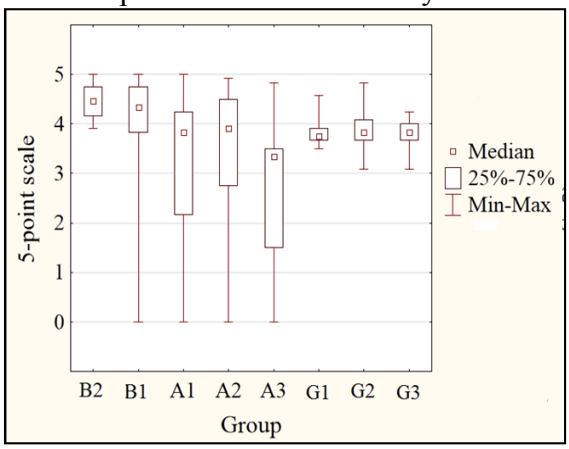

Fig. 1. Diagram scope IDH

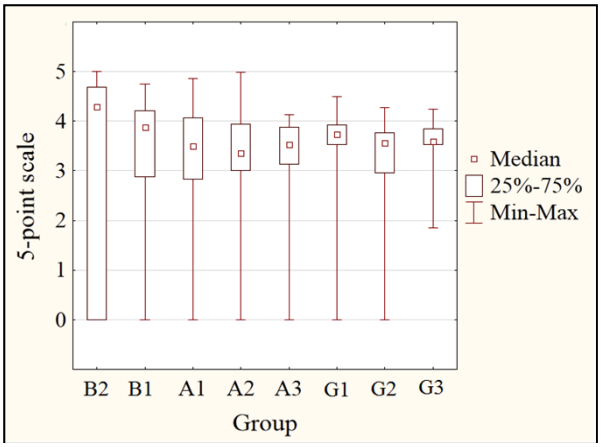

Fig. 2. Diagram scope EX

Given that the original data are measured on an ordinal scale, non-parametric anova of independent samples was used. According to rank Kruskal-Wallis test and the median test difference of 8 groups together are highly significant (significance level $p < 0.0005$) for the variable IDH due to highly significant difference between the groups A3 and B2, A3 and B1 ($p < 0,0005$), and for EX – not significant ($0.05 < p_{K-U} \approx 0,49$; $p_m \approx 0,16 < 0,1$) (Fig. 1-2). In the comparison of dependent variables IDH and EX using nonparametric sign test and Wilcoxon test strongly significant differences between the variables on the set 8 of groups (significance level $0.0005 < p_{k-z} \approx 0,0007$; $p_W \approx 0,0015 < 0$) were revealed. During the non-parametric estimation of the dynamics of the groups insignificant group dynamics

A2, A1, G1, G3, B1 (p > 0,1); strongly significant dynamics G2, A3 and B2 (0,0005 < p < 0,005) were revealed.

During the univariate parametric ANOVA, highly significant (p <0.0005) differences in the variable group averages IDH due to highly significant differences from the rest of the A3, except A1 and A2, and insignificant variable EX (p ≈ 0,76> 0.10) were revealed. As a result of ANOVA of repeated measurements it was revealed that the combination of 8-group averages in the variables IDH and EX have highly significant difference (0.0005 <p ≈ 0,0043 <0,0050) at the expense of strongly significant differences EX and IDH in B2 (0.0005 <p ≈ 0,002 <0,005); and statistically significant in A3 and G2 (0.005 <p <0.05) (Fig. 3). By the method of K based on analysis of variance, clustering of groups in all variables IDH and EX was performed. The result is a partition of 8 groups of 4 cluster (Fig. 4). According to analysis of variance clusters of student groups differ highly significantly in the variable IDH (p ≈ 0,00017 <0,00050) and weakly significant in EX (0.05 <p ≈ 0,096 <0,1). The results of the parametric ANOVA and clustering are illustrated in Fig. 3-4.

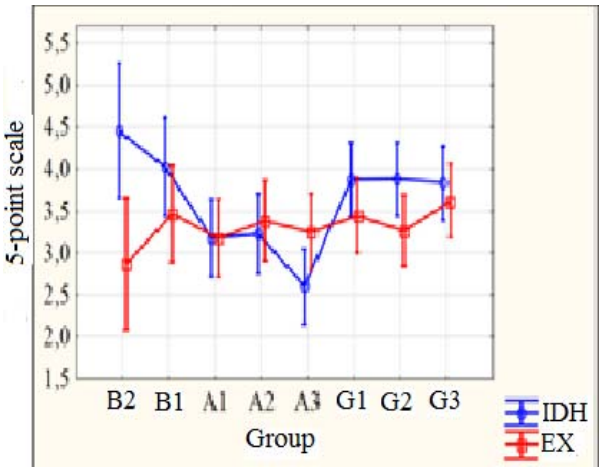

Fig. 3. Charts medium IDH and EX

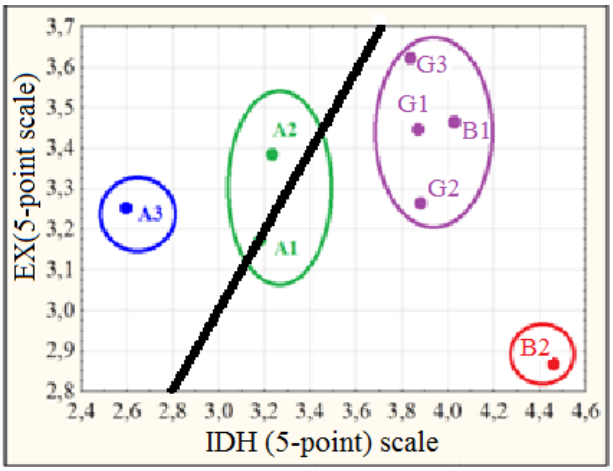

Fig. 4. Diagram of scattering

Fig. 4 shows a further direct of the zero dynamics (equality of group means IDH and EX), against which it is seen that the students of A3 show a statistically significant positive trend (0.005 <p ≈ 0,024 <0,05), the students of A2 and A1 – insignificant (have almost the same assessment during the semester and exam), G1, G3, and B1 have a slightly negative dynamics (p> 0.1), G2 statistically significant (0.005 <p ≈ 0,03 <0,05), and students of group B2 have a strongly significant negative trend (0.0005 <p ≈ 0,002 <0,005). The latter fact is indicative of poor preparation of students for the exam B2 group or non-participation in the exam at all.

Built dispersion and cluster model of educational space can be used for monitoring academic performance of university students.

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