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SYSTEM-COGNITIVE ANALYSIS OF THE IMPACT OF PRE-UNIVERSITY ADDITIONAL MATHEMATICAL EDUCATION ON THE SUCCESS OF UNIVERSITY STUDIES

Research article

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Abstract

The dependence of academic achievements of university students on their studies in the educational unit "Small Mathematical Faculty" during secondary school and the results of the Unified State Exam was studied. A sample of 129 students of the Faculty of Mathematics and Computer Science of the Kuban State University of the 02.03.01 mathematics and computer Science for 2019-2022 was studied. The study was conducted using automated system-cognitive analysis (ASC-analysis) and its software tools – the intelligent system "Eidos".

The main conclusion that can be reasonably drawn based on the analysis of the above cognitive functions is that training in the educational unit of the Small Math Faculty is a factor that unequivocally positively affects the success of teaching in mathematical disciplines. Thus, the main hypothesis put forward at the beginning of the work is confirmed.

Perhaps somewhat unexpectedly, but contrary to the point of view of the critics of the Unified State Exam, an additional hypothesis is confirmed that the higher the score of the Unified State Exam, the higher the success rate of students at the university. Thus, it is possible to draw a reasonable conclusion that, after all, the Unified State Exam really measures the level of subject exposure of students and their ability to future academic achievements at the university.

Keywords: automated system-cognitive analysis, ASC-analysis, "Eidos" system, pre-university additional mathematical education, the success of studying at the university.

СИСТЕМНО-КОГНИТИВНЫЙ АНАЛИЗ ВЛИЯНИЯ ДОВУЗОВСКОГО ДОПОЛНИТЕЛЬНОГО МАТЕМАТИЧЕСКОГО ОБРАЗОВАНИЯ НА УСПЕШНОСТЬ ОБУЧЕНИЯ В ВУЗЕ

Научная статья

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Аннотация

Изучена зависимость учебных достижений студентов университета от их обучения в учебном подразделении «Малый математический факультет» в период обучения в средней школе и результатов ЕГЭ. Исследовалась выборка по 129 студентам факультета математики и компьютерных наук Кубанского государственного университета направления подготовки 02.03.01 математика и компьютерные науки за 2019-2022 годы. Исследование проведено с применением автоматизированного системно-когнитивного анализа (АСК-анализ) и его программного инструментария – интеллектуальной системы «Эйдос».

Главный вывод, который можно обоснованно сделать на основе анализа приведенных когнитивных функций состоит в том, что обучение в учебном подразделении Малый матфак является фактором, однозначно положительно влияющим на успешность обучения по математическим дисциплинам. Таким образом, *подтверждается главная гипотеза*, выдвинутая в начале работы.

Возможно, несколько неожиданно, но вопреки точке зрения критиков ЕГЭ, *подтверждается и дополнительная гипотеза* о том, что чем выше балл ЕГЭ, тем выше и успешность обучения учащихся в вузе. Таким образом, можно сделать обоснованный вывод о том, что все-таки ЕГЭ реально измеряет уровень предметной обученности учащихся и их способности к будущим учебным достижениям в вузе.

Ключевые слова: автоматизированный системно-когнитивный анализ, АСК-анализ, система «Эйдос», довузовское дополнительного математического образования, успешность обучения в вузе.

Introduction

1.1. Description of the researched subject area

The paper solves the problem of identifying the dependence of the educational achievements of undergraduate students of the Faculty of Mathematics and Computer Science of the Kuban State University on their education in the educational unit of the Faculty of Mathematics and Computer Science "KubSU" "Small Faculty of Mathematics" (Small Mathematical Faculty) during the period of study in the senior classes of secondary school and from the results of the exam.

Based on the knowledge of these dependencies, various problems of forecasting, decision-making and research of the modelled subject area are solved by studying its system-cognitive model (SC-model).

1.2. Object and subject of research

The dependence of educational achievements of university students on their education in the educational unit Small Mathematical Faculty during the period of study in secondary school and on the results of the Unified State Examination has been studied. We studied a sample of 129 students of the Faculty of Mathematics and Computer Science of the Kuban State University, majoring in mathematics and computer science 02.03.01 for 2019-2022. The study was carried out using automated system-cognitive analysis (ASC-analysis) and its software tools - the intellectual system "Eidos".

Object of study – revealing the dependence of educational achievements of university students on their education in secondary school.

Subject of study – revealing the dependencies between the educational achievements of undergraduate students of the Faculty of Mathematics and Computer Science of the Kuban State University in various disciplines on their education in the educational unit Small Mathematical Faculty in the upper grades of secondary school and on the Unified State Examination.

1.3. The problem solved in the work and its relevance

The USE system is a centralized federal state system that has full multifaceted and comprehensive state support at all levels of the USE organization: from federal to regional (regional, district) and the level of a particular secondary school.

In contrast to the Unified State Examination, the support of talented youth and their preparation for successful studies at the university is actually left to the mercy of these young people and their parents.

Separately, there is the question of the organization and effectiveness of pre-university training of schoolchildren for studying at a university.

Thus, we have to admit that the current situation with the pre-university preparation of high school students for successful study at a university is far from ideal.

Thus, a problem is revealed, which consists in a contradiction between the actual and desired (target) situation in preparing high school students for successful study at a university. This problem gives rise to two options for the work of pre-university structures: to organize pre-university training for students or / and purposefully prepare them for the successful passing of the USE.

A natural question arises as to how effective the Small Math Faculty is as a structure for pre-university training. In this work, the main hypothesis is tested: do students who have completed training at the Small Mathematical Faculty systematically consistently demonstrate higher educational achievements than those who do not have this training?

In addition, the paper tests an additional hypothesis about the existence of a relationship between the results of the Unified State Examination and the success of studying at a university and specifies the nature of this relationship.

This work, apparently, is one of the first in which artificial intelligence methods are used to solve the problem of assessing the effectiveness of pre-university training and the adequacy of the USE.

This makes this work very relevant.

To solve this problem, a hybrid model is developed in the work, which includes both textual (nominal and ordinal) and numerical measuring scales and ensures comparability of processing data of different types, presented in different types of scales and different units of measurement.

1.4. Goal of the work

The achievement of the set goal is ensured by the solution of a number of tasks and subtasks, which are the stages of achieving the goal. The specific formulation of these tasks depends on the method of solving the problem; therefore, we will reasonably formulate them at the end of the section, i.e. after a reasonable choice and description of the method of solving the problem.

Main results

As already shown above, to work with linguistic variables, it is advisable to apply linguistic ASC-analysis.

Achieving the goal in ASC-analysis is ensured by solving the following tasks and subtasks, which are the stages of achieving the goal:

Task-1. Cognitive structuring of the subject area;

Task-2. Formalization of the subject area;

Task-3. Synthesis of statistical and system-cognitive models. Multiparameter typification and particular knowledge criteria;

Task-4. Model verification;

Task-5. Selection of the most reliable model;

Task-6. System identification and forecasting. Integral criteria of knowledge;

Task-7. Decision support (A simplified version of decision-making as an inverse problem of forecasting, positive and negative information portraits of classes, SWOT analysis; Developed decision-making algorithm in ASC analysis);

*Task-8. S*tudy of the object of modeling by studying its model includes a number of subtasks:

1) inverted SWOT diagrams of descriptive scale values (semantic potentials);
2) cluster-constructive analysis of classes;
3) cluster-constructive analysis of the values of descriptive scales;
4) knowledge model of the "Eidos" system and non-local neurons;
5) non-local neural network;
6) 3d-integrated cognitive maps;
7) 2d-integral cognitive maps of meaningful class comparison (mediated fuzzy plausible reasoning);
8) 2d-integrated cognitive maps of meaningful comparison of factor values (mediated fuzzy plausible reasoning);
9) cognitive functions;

10) the significance of descriptive scales and their gradations;
11) the degree of determinism of classes and classification scales.

Discussion

The results obtained can be assessed as successfully solving the problem formulated in the work and ensuring the achievement of the goal set in the work. These results were obtained by using the linguistic Automated System Cognitive Analysis (linguistic ASC-analysis) and its software tools – the intellectual system "Eidos".

Achievement of this work is:

1. Possibility of constructing system-cognitive models of the subject area based on initial data containing linguistic variables;

2. The possibility of using system-cognitive models for solving problems of forecasting, decision-making and research of the modelled subject area.

As a prospect for continuing research, it would be recommended to significantly increase the amount of initial data, the number of factors studied, as well as the number of classification scales and their gradations (classes) to describe the future states of the modeling object.

For example, in the system-cognitive models being created, it would be possible to study the impact on the educational achievements of students of higher educational institutions of study in the educational unit Small Math Faculty and the results of the USE not in one, but in several areas of training and specialties.

The prospects and value of the results of such research and development for theory and practice are beyond doubt, which is confirmed by the works of the authors in this field [1], [2], [3], [4].

Those who wish have every opportunity to study this work and for further research using ASC analysis and the Eidos system on their computer.

To do this, you need to download the system from the developer's website using the link on the page: lc.kubagro.ru/aidos/_Aidos-X.htm, and then in the application manager (mode 1.3) install the intelligent cloud Eidos application No.348. There are a large number of video lessons (about 300) on various aspects of the application of this technology, which can be found at the links on the page: lc.kubagro.ru/aidos/How_to_make_your_own_cloud_Eidos-application.pdf.

Conclusion

The main conclusion which can reasonably be done based on the analysis of the created model is that learning at a small mathematical faculty is a strong factor that definitely positively affects the success of teaching in mathematical disciplines. Thus, the main hypothesis put forward at the beginning of the work is confirmed.

An additional hypothesis was also confirmed, that the higher the USE score, the higher the success of students in higher education.

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Конфликт интересов

Не указан.

Рецензия

Все статьи проходят рецензирование. Но рецензент или автор статьи предпочли не публиковать рецензию к этой статье в открытом доступе. Рецензия может быть предоставлена компетентным органам по запросу.

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Conflict of Interest

None declared.

Review

All articles are peer-reviewed. But the reviewer or the author of the article chose not to publish a review of this article in the public domain. The review can be provided to the competent authorities upon request.

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