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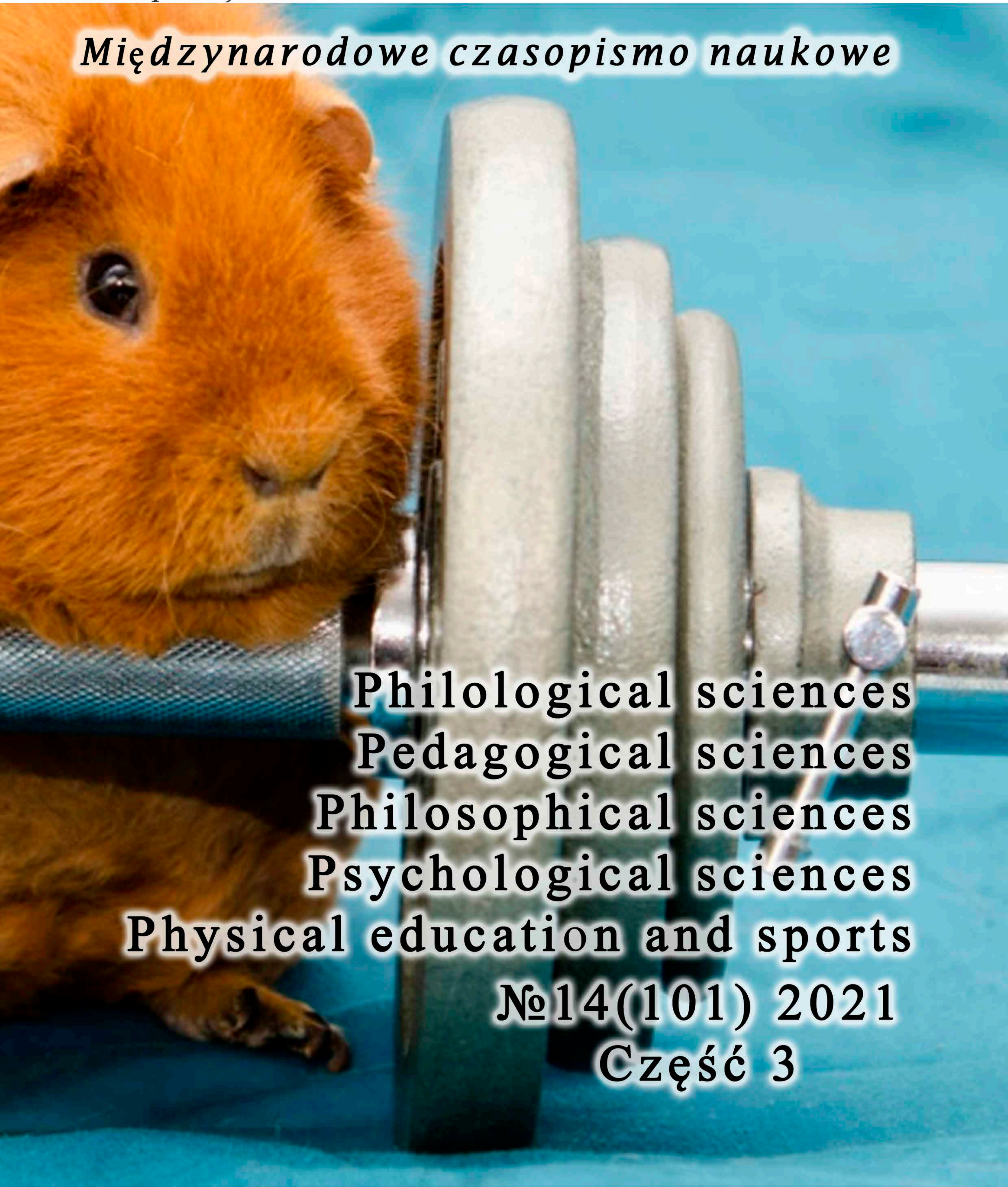

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ПАКЕТ ПРИЛОЖЕНИЙ MATHCAD КАК СРЕДСТВО ПОВЫШЕНИЯ ЭФФЕКТИВНОСТИ МАТЕМАТИЧЕСКОЙ ПОДГОТОВКИ БУДУЩИХ ЭКОНОМИСТОВ-АГРАРНИКОВ

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APPLICATION PACKAGE MATHCAD AS A MEANS OF INCREASING THE EFFICIENCY OF MATHEMATICAL TRAINING OF FUTURE ECONOMISTS-AGRARIANS

Аннотация.

В статье обосновывается, что современная аграрная экономика сейчас невозможна без применения информационных технологий. К сожалению, традиционная система подготовки полностью не решает проблемы воспитания специалистов экономического направления с должным уровнем информационно-технологической подготовки, способных применять в своей деятельности инновационные методы, способных быстро адаптироваться к новым условиям производства. Возникает проблема совершенствования подготовки экономистов-аграриев к использованию компьютерных технологий в будущей профессиональной деятельности.

Обращается внимание, что важное место в фундаментальном образовании выпускников аграрных университетов занимает математическая подготовка. Вместе с тем она является основой специальной подготовки будущего экономиста.

Обращается внимание на то, что аграрные университеты дают широкий спектр знаний, умений, навыков, но недостаточно способствуют тому, чтобы они формировали соответствующие профессиональные компетенции. Структура компетентности специалиста предполагает опыт, направленность, качества.

Приблизиться к решению указанных противоречий представляется с решением проблемы повышения эффективности обучения, активизации учебно-познавательной деятельности.

Одним из путей является внедрение информационных технологий в процесс математической подготовки, которое должно проводиться в комплексе с разработкой соответствующего методического обеспечения.

Появление различных систем компьютерной математики стало средством бурного развития и проникновения компьютеров во все сферы жизнедеятельности человека. С их появлением появились не только возможности, но и необходимость качественно изменить технологию обучения и форму подачи материала, сделав его более доступным и наглядным, а обучение более эффективным.

В статье обосновывается использование универсального прикладного математического пакета Mathcad как средства, позволяющего реализовать процесс подготовки будущих аграриев на принципиально новом уровне благодаря возможности получать и обрабатывать информацию разных типов.

Рассмотрено, как использование Mathcad в процессе изучения математики способствует реализации дидактических принципов обучения: научности, фундаментализации, межпредметных связей, системности, практической значимости, доступности, наглядности. профессиональной направленности, меры, комплексного и коллективного характера, гуманистический, опережающего обучения.

На примере математического программного пакета Mathcad аргументировано целесообразность использования информационных технологий для екаспериментальнои обработки данных качественного характера в экономических исследованиях.

Abstract.

The article substantiates that the modern agrarian economy is now impossible without the use of information technology. Unfortunately, the traditional training system does not completely solve the problem of educating specialists in the economic field with the proper level of information technology training, capable of applying innovative methods in their activities, capable of quickly adapting to new production conditions. The problem arises of improving the training of agricultural economists for the use of computer technologies in their future professional activities.

Attention is drawn to the fact that mathematical training occupies an important place in the fundamental education of graduates of agricultural universities. At the same time, it is the basis for the special training of the future economist.

Attention is drawn to the fact that agrarian universities provide a wide range of knowledge, abilities, skills, but do not sufficiently contribute to the formation of appropriate professional competencies. The structure of a specialist's competence assumes experience, focus, quality.

Approaching the solution of these contradictions seems to be with the solution of the problem of increasing the effectiveness of training, enhancing educational and cognitive activity.

One of the ways is the introduction of information technologies in the process of mathematical training, which should be carried out in conjunction with the development of appropriate methodological support.

The emergence of various systems of computer mathematics has become a means of rapid development and penetration of computers into all spheres of human life. With their appearance, not only opportunities appeared, but also the need to qualitatively change the technology of teaching and the form of presentation of the material, making it more accessible and visual, and teaching more effective.

The article substantiates the use of the universal applied mathematical package Mathcad as a means to implement the process of preparing future farmers at a fundamentally new level due to the ability to receive and process information of different types.

It is considered how the use of Mathcad in the process of studying mathematics contributes to the implementation of the didactic principles of teaching: scientific nature, fundamentalization, interdisciplinary connections, consistency, practical significance, accessibility, clarity. professional orientation, measures, complex and collective nature, humanistic, anticipatory learning.

On the example of the mathematical software package Mathcad, the expediency of using information technologies for experimental processing of qualitative data in economic research is argued.

Ключевые слова: *Mathcad, компьютерные программы, информационные технологии, математическая подготовка, подготовка агрария, экономическое образование, фундаментальное образование, принципы обучения, экспериментальная обработка количественных и качественных данных.*

Keywords: *Mathcad, computer programs, information technology, mathematical training, preparation of a farmer, economic education, fundamental education, teaching principles, experimental processing of quantitative and qualitative data.*

Formulation of the problem. The modern agrarian economy is now impossible without the use of information technology. Unfortunately, the traditional training system does not completely solve the problem of educating specialists in the economic field with the proper level of information and technological training, capable of applying innovative methods in their activities, capable of quickly adapting to new production conditions. The problem arises of improving the training of agricultural economists for the use of computer technologies in their future professional activities.

On the other hand, mathematical training occupies an important place in the fundamental education of graduates of agricultural universities. At the same time, it is the basis for the special training of the future economist. This is due to the significant interdisciplinary function of mathematics, including in the agricultural economy. Indeed, a number of its concepts (derivative, integral) have an economic, biological, chemical, mechanical meaning.

Nowadays, agricultural universities provide a wide range of knowledge, skills, and skills, including mathematical ones, but they do not sufficiently contribute to the formation of appropriate professional competencies. The structure of a specialist's competence provides for experience (knowledge, skills, abilities), focus (needs, values, motives, drives, ideals, etc.), quality (the ability to synergistic manifestations, adaptation, scaling and interpretation, self-development, integration, transfer of knowledge from one area to another, etc.) [1, p.14].

Approaching the solution of these contradictions seems to be with the solution of the problem of increasing the effectiveness of training, enhancing educational and cognitive activity.

One of the ways is the introduction of information technologies in the process of mathematical training, which should be carried out in conjunction with the development of appropriate methodological support.

The emergence of various systems of computer mathematics has become a means of rapid development and penetration of computers into all spheres of human life. With their appearance, not only opportunities appeared, but also the need, without abandoning the principles of the fundamental nature of classical education, to qualitatively change the teaching technology and the form of material presentation, making it more accessible and visual, and teaching more effective.

Issues related to the informatization of education were considered by N. Apatova, I. Bogdanova, G. Gurevich, Yu. Zhuk, V. Klochko, L. Romanishina.

In particular, E. Velikhov, B. Glinsky, V. Glushkov, A. Dorodnitsyn, A. Ershov, V. Mikhalevich, M. Moiseevim and others; substantiation of the logical and psychological foundations for the use of computer training aids in the process of vocational education - P. Galperin, V. Bespalko, T. Ilyina, V. Kantelinin, V. Lvovskiy, V. Mulradov, V. Rubtsova and others; implementation of didactic functions of computers in the study of individual courses in the professional direction - P. Goncharov, O. Zuevim, S. Kovaleva, P. Kuznetsov, etc.

The mentioned scientists agree that only in combination with the appropriate educational and methodological support of the use of computer technologies gives positive results and is a step towards the development of the processes of humanization and informatization of vocational education. R. Gurevich focuses on the thesis that the introduction of information and communication technologies should take place with the awareness of the goals, methods, methods, techniques of their inclusion in the process of training specialists [2]. S. Yatsyuk notes that "the concept of" new information technologies "is associated with the emergence of applied software packages that provide the user with great opportunities in processing, storing and transferring text, graphic information, the ability to access huge amounts of information, search for the necessary" [3, p.2].

However, the analysis of the content of scientific works showed that a deep and systematic study of the problem of introducing information technologies in the process of training future farmers has not been carried out, in particular, there is no development of appropriate didactic systems.

At the same time, the system of higher economic education is faced with the need, on the one hand, to fulfill the social order of society for training a specialist of a new formation, and on the other hand, to satisfy the needs of the individual to receive high-quality educational and special training. Both tasks are impossible without mastering modern information technologies.

In addition, now there is a rich variety of methods for analyzing the phenomena and processes of reality, which make it possible to draw sufficiently high-quality and accurate conclusions. The analysis of special literature testifies to the diverse approaches to the problem of experimental data processing in economic research, which is due to the specifics of each individual [4,5,6].

In the process of studying objects characterized by a large number of factors, the question often arises which of these factors most affects their properties.

Analysis of the problem of experimental verification of the results of economic research has made it possible to single out 2 directions in assessing their effectiveness: quantitative and qualitative. Recently, quantitative analysis has been carried out using special software packages. However, the use of these packages for analysis has not yet become widespread.

Formulation of the problem. In the article, we set the task of substantiating the use of the universal applied mathematical package Mathcad as a means to implement the process of preparing future farmers at a fundamentally new level due to the ability to receive and process information of different types.

To argue the expediency of using information technologies for experimental data processing in economic research, which are not only quantitative but also qualitative in nature using the example of the mathematical software package Mathcad.

Presentation of the main material. At present, a number of mathematical systems have been developed and are functioning: Maple, Matlab, Mathematica, etc. Most systems use integer representation and symbolic data processing, Matlab is focused on working with arrays. Against the background of the above-mentioned systems of computer mathematics, the Mathcad system stands out.

In the process of mathematical training of agrarians, we chose Mathcad because it is now a simple and at the same time powerful universal environment for solving problems from various fields of science and technology, finance and economics, mathematics and statistics, physics and astronomy, production organization and management. She is armed with a wide range of instrumental, graphic and informational means.

– Mathcad allows you to solve problems both numerically and symbolically.

– Recording tasks in Mathcad is as close as possible to recording without using computers, which greatly simplifies the use of the system.

– Mathcad is much cheaper than its counterparts.

– Mathcad is a universal system, not a specialized one.

– Mathcad provides a powerful enough system for visualization of calculation results in the form of various types of graphs.

– Mathcad can interact with other systems.

– Mathcad has built-in text, graphic, formula editors. They are endowed with a user-friendly interface.

– A number of economic functions (financial) are built into Mathcad.

Over the years, Mathcad has gained importance in various spheres of human activity, the boundaries of its application have rapidly spread due to significant opportunities.

Now the latest version of the mathematical software package Mathcad-14 allows you to perform a wide range of symbolic transformations, including operations of mathematical analysis, such as differentiation, integration, scheduling in series, solving differential equations, etc.

For visualization of mathematical objects, Mathcad contains two- and three-dimensional graphics. The possibility of using various numerical methods, the combination of symbolic, graphical and numerical calculations makes this package an extremely powerful and convenient tool for mathematical research.

Now Mathcad is used in various branches of science - mathematics, physics, biology, economics, mechanics, and the like. We consider Mathcad as the basis for the transformation of the traditional course of higher mathematics at an agricultural university. Step by step, acquiring skills and abilities to work in the system, students gradually master modern modeling tools, they gain access to the world experience in solving scientific problems in various branches of the agricultural sector.

The effectiveness of using Mathcad in the educational process is determined by its compliance with specific goals and objectives, the specifics of educational material, forms and methods of organizing the activities of a teacher and student, material and technical conditions. This package can be used in a wide variety of content and organization of classroom and classroom activities. At the same time, it organically fits into the framework of traditional education with the widespread use of the entire arsenal of educational tools.

So, the mathematical software package Mathcad is endowed with certain didactic features, in particular:

- the possibility of a deeper penetration into the content of objects and phenomena being studied;
- illustration of objects and phenomena, if necessary, even in dynamics;
- information richness;

- a variety of visual techniques, their expressiveness, emotional richness;
- lack of temporal and spatial boundaries.

Among the conditions for introducing the Mathcad system into the educational process, we single out: the organizational component (database, training), personal and psychological indicators of the readiness of participants in the pedagogical process for new forms of activity, technological support of the process (didactic and methodological circumstances and procedures that ensure the success of the result).

Mainly in research related to the implementation of mathematical systems in academic subjects, the authors relate to the target and content-educational part of it. Reasonable goals for the introduction of information technology in the educational process, developed training content and individual didactic materials. However, the study of the stages that relate to the procedural component of the implementation of information systems in the mathematical training of future specialists has not been completed. This also applies to the implementation of the Mathcad system in the mathematical training of future farmers. Therefore, we will focus on this aspect.

The means of introducing the Mathcad system into the educational process are curricula, programs, textbooks, manuals. We have a positive experience of using this system in the design of traditional and innovative teaching materials, in particular, guidelines, electronic manuals, electronic documents containing the visualization of theoretical provisions, presentations in lecture courses.

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Using the Mathcad system in combination with modern multimedia design tools allows you to improve the quality of traditional presentations when conducting various types of lectures. For example, when preparing a lecture-visualization, realizing the principle of clarity, the use of the Mathcad system leads not only to an increase in the perception of educational material, but also allows you to penetrate deeper into its essence. The visualized educational information, being perceived and realized, serves as a good support for practical application.

At the same time, the rich graphic capabilities of the Mathcad system allow you to prepare educational material that not only complements verbal information, but also acts as a carrier of meaningful information.

As fragments of the presentation, there can be not only two-dimensional and three-dimensional graphics, text, statistical and dynamic graphic objects, but also animations

Also, in the procedural plan of the application, Mathcad makes it possible to use various forms and methods of teaching, in which the cognitive activity of students is activated. The indicated technology allows the use of independent, problematic, practical, research, creative work. The task includes both group and individual activities, in the classroom and outside.

For example, on the basis of the Mathcad system, you can prepare and conduct a problem lecture, while new knowledge is introduced as it is not known what needs to be "discovered". The teacher, using the entire arsenal of the system's means, creates a problem situation, encouraging students to search for a solution to the problem, showing contradictions and solving them in the process of cooperation. At the same time, the process of cognition in this form of presentation of the material approaches search, research activity, with its help creative thinking develops, interest in the content of the subject increases, and professional motivation is provided.

With the use of the Mathcad system, it becomes possible to introduce computer modeling into the educational process. The methodological task in this case is to preliminarily determine the ways of using the system's means to conduct research and interpret the results that ensure high efficiency of the learning process. Using the system allows you to set tasks related to various groups of sciences, the implementation of which is associated with comparison, correlation, generalization, transfer.

Thus, students get acquainted with the stages of scientific knowledge, the possibilities of modeling at the modern level, basic mathematical concepts are formed, a high level of knowledge is achieved in various fields of science, including in the agricultural sphere.

Using the Mathcad system in the study of mathematics allows you to implement one of the new forms of education - distance learning, successfully combine it with full-time education.

For example, acquaintance with the materials of the mathematical educational site www.exponenta.ru. allows students to use a database containing various examples of performing tasks in the Mathcad system in higher mathematics in the Internet class section, find electronic manuals, reference books, articles, ask your question for discussion on the forum. The teacher can use the system to support his course of lectures, use methodological developments or post his own to find examples of the application of the system in the educational process.

Thus, the cognitive and creative activity of students is activated, the result of which can be their participation in competitions for the best student work using the mathematical package Mathcad, conducted by the founders of the site. This lays the foundations for the implementation of successful scientific and professional activities.

The didactic materials were developed using the Mathcad system and posted on the website of the educational institution, which make it possible to access them at any time, which contributes to the flexibility of training and the development of an individual trajectory.

The final part of the technology for implementing the Mathcad system in the mathematical training of specialists is the diagnosis of knowledge, which provides for the development of adequate control methods. We can determine the quality of a specialist's knowledge only in a direct way, with the help of specially selected tasks. The adequacy of control consists in setting a task that requires the student to perform those intellectual actions with those characteristics that interest us and that we want to evaluate. One of the main goals of the planned technology was the formation of students' ability to independently, consciously and rationally use the Mathcad system in solving problems related to "pure" mathematics and applied problems requiring a mathematical apparatus.

At the same time, this technology is open to other computer and information learning tools. For example, we use elements of distance learning, the electronic control system "Socrates", in particular for testing students' knowledge.

However, as noted earlier, the implementation of Mathcad should take place under certain didactic conditions, which include the principles of teaching. At the same time, didactic principles manifested in information technologies of education have their own specifics. Let us consider how the use of Mathcad in the process of studying mathematics at an agricultural university contributes to the implementation of didactic principles of teaching.

The principle of scientific teaching is realized when, with the help of Mathcad, it becomes possible to reflect in the content of this discipline more fundamental scientific research, to formulate knowledge about general scientific methods of cognition and about methods specific to a particular stage in the development of mathematics and the degree of their application at the present time.

In junior courses, the principle of scientific teaching approaches the principle of fundamentalization, one of the aspects of which is the general educational component. The use of Mathcad contributes to the formation of the skills of interpreting and analyzing the results of activities, using databases and data banks, using a computer, mastering a foreign language, which refers to general education.

Realizing the principle of interdisciplinary connections, the use of Mathcad in the process of studying mathematics at an agrarian university contributes to the reflection in the sense of this discipline of the variety of connections that operate in nature and society and are studied by modern sciences. At the same time, interdisciplinary connections act as an equivalent of inter-scientific, the methodological basis of which is the process of integration and differentiation of scientific knowledge.

The wide capabilities of Mathcad allow us to consider a large number of examples of the application of mathematics in various areas of the agricultural sphere, the consideration of which would be impossible due to the complexity of the objects and the limited study time.

None of the lessons in mathematics is impossible without observing the principle of consistency. With the use of Mathcad, this principle is implemented even more universally by reflecting content-logical connections, taking into account the cognitive capabilities of students, preliminary training and the content of special disciplines.

The novelty of the educational material presented with the help of Mathcad, illustrations in and the practical significance of the concepts studied forms the motivation of students and forms a positive emotional background. This, in turn, contributes to the activation of learning, which is closely related to the formation of sustainable cognitive interest.

The actual level of yesterday's schoolchildren and today's students is different. This level is often low. However, for all students, without exception, Mathcad causes sincere interest, even before the material that seemed already familiar from school. This is due to the fact that the use of video, audio, animation, which is equipped with Mathcad, the educational material acquires a new sound, and for students with poor preparation makes the material accessible, visual, implementing the principles of accessibility and clarity.

The implementation of the principle of professional orientation of education, which is of particular importance in higher education, in relation to the general course of higher mathematics at Agran universities using Mathcad, is expressed not in the introduction of separate, fragmentary information into the educational process, studied within special disciplines, but in the formation of students integrated professionally significant skills and abilities. Professionally significant skills for future agrarians include, for example, the ability to alalize the role and degree of influence of factors and conditions on the nature of the studied phenomenon, the identification of significant and secondary ones, the ability to identify such conditions in the dynamics of the studied phenomenon or object, when an initially secondary factor acquires significance and on the contrary, the ability to interpret experimentally obtained data presented on graphs, tables, diagrams, histograms, as well as the ability to use modern tools for their construction.

The most significant among the additional principles that are implemented through the use of Mathcad in the educational process are: the humanistic principle and the principle of advanced learning.

With the use of Mathcad, the most favorable conditions are created for students to acquire the knowledge necessary for their future professional activities, for the development of creative individuality, high personality traits. The principle of advanced learning is implemented not only through the transfer of the world scientific and cultural heritage to students, but with the formation of knowledge, skills and new skills, emotional and value qualities that will allow tomorrow's graduates to adapt in a rapidly changing world.

The principle of measure and the principle of an integrated nature is manifested when the use of the Mathcad package is not an end in itself, but a certain information saturation of the educational process is planned and determined with the help of this package, the uncontrolled use of which can lead to a decrease in the quality of assimilation of educational material. After all, none of the available teaching tools, even modern information technologies with their significant capabilities, can be opposed to another. Since when solving certain didactic tasks, only in certain educational situations one of them turns out to be more effective than others. Therefore, the use of Mathcad is necessary in combination with other, both traditional and new teaching aids, for example, printed textbooks and multimedia systems.

With the use of Mathcad in the process of teaching higher mathematics at the agrarian university, creativity and initiative of students is realized in combination with pedagogical guidance, there is a shift in emphasis from formal leadership towards active learning.

The implementation of the principle of the collective nature of learning in combination with the development of individual characteristics of students is realized when the use of Mathcad with its wide capabilities allows, creating an individual trajectory of movement for an individual student, to solve collective problems.

In matters of qualitative and quantitative analysis of mass phenomena in the economy, an important place is occupied by the methods of mathematical statistics. The use of mathematical and statistical methods makes it possible to assess entrepreneurial and financial risks, to create conditions for increasing production efficiency based on a reliable assessment of the state and capabilities of various fields of activity.

In economic research, most of the methods are based on the analysis of strictly formalized information. At the same time, those "informal" aspects of economic reality are left without attention, and often actually determine its result.

In our research, we use expert assessments, or more precisely, expert assessment methods. An expert, in whose role an authoritative specialist can act, is able to identify and evaluate all the essential aspects of the phenomenon under study. It only remains to systematize these estimates and get a final conclusion.

The assessments carried out by the expert group are recorded in tables and further processed in the Mathsad environment. We chose this system for data processing, because it is a universal integrated system that has significant capabilities in working with mathematical statistics. In particular, it contains a large number of built-in special functions that allow you to quickly process a sample of random variables [7, 8, 9]. In the process of statistical analysis Mathsad avoids cumbersome calculations using common formulas to find the numerical characteristics of random variables [10, p.92-96], - just enter the observation data or survey results.

For example, to evaluate and compare samples of destabilizing factors of the economy, we find the arithmetic mean, mode, median, variance, standard deviation, using the built-in functions: mean (A), mode (A, B, C, ...), median (A, B, C ...), Var (A, B, C ...), Stdev (A), where A, B, C are data matrices (scores, equals, scores, etc.). These are means and deviations from the means: arithmetic mean, median, mode, variance and standard deviation.

An integral part of statistical analysis, in addition to the definition and analysis of absolute indicators, is relative.

In particular, it is noted: "absolute indicators play an important role in the system of generalized statistical indicators. At the same time, they cannot give a sufficiently complete picture of the phenomenon under study. Therefore, there is a need to calculate other generalizing indicators - relative and average values. [10, p.87] The author continues: “relative values are generalizing quantitative indicators that express the ratio of the compared absolute values .... relative values can be expressed in the following forms: coefficients (shares), percentages (%) ... "[10, p. 88].

Therefore, we process the results to determine the relative importance of each destabilizing factor in the economy. To do this, we first normalize the individual indicators, and then calculate the weighted averages. Rationing is a transition from absolute values to relative values. The average weight of each factor (normalized estimate) is expressed by the coefficient of significance Wj, which is calculated by the formula:

$$W_j = \frac{\sum_{i=1}^{m} W_{ij}}{\sum_{j=1}^{n}\sum_{i=1}^{m} W_{ij}}$$

Statistical analysis of Mathcad allows you to avoid cumbersome calculations using common formulas for finding the numerical characteristics of random variables, - you just need to enter observational data or survey results.

In practical and scientific activities, it is often necessary, on the basis of the results of surveys, to check various assumptions about the characteristics of mass phenomena. So, when changing one variety of any agricultural crop to another, one should check the assumption that the other variety has a higher yield compared to the first. Or vice versa - the yield of three varieties K, E1 and E2 does not differ.

For example, in one of our works, the following hypotheses were formulated:

H_0: the yield indicators of the three experimental wheat varieties do not differ, different results obtained in individual plots are random.

H_1: the different yield results are not random, the yield results of the three test wheat varieties differ significantly. Estimation of the mathematical expectation was carried out using the Student distribution.

To test the hypothesis, we compared the yield indicator on a 12-point scale in the selected varieties in pairs:

- control (K) and experimental (E1),
- control (K) and experimental (E2),
- experimental (E1) and experimental (E2).

The analysis of the results obtained and their reduction to the object form was carried out by means of Mathcad. For data processing, the named universal integrated system was chosen, which has significant capabilities in working with problems of mathematical statistics. In particular, it contains a large number of built-in special functions that allow you to quickly process a sample of random variables.

In order to test statistical hypotheses about the degree of differences between samples of random variables, the Student's test was used with the degree of freedom of distribution N-1, where N is the sample size. The indicator of acceptance or rejection of the hypothesis was the quantile of the Student's distribution X_r and X_l, which was a critical value for accepting or rejecting the hypothesis. If the sample value was within $X_l < \varphi < X_r$, then the null hypothesis was accepted. For the significance level of 0.9, the inequality was indicated as: $-1{,}645 < \varphi < 1{,}645$.

Figure 1 shows a fragment of a working paper with the corresponding calculations, containing hypothesis testing.

The volume of samples is equal to the areas of the experimental plots - 62 cu, 58 cu, 60 cu. (1 cu = 10 weaving.). The obtained numerical values show that the average yield values are respectively equal to 7.71; 7.328; 7.4. We also estimated the values characterizing the deviation of the yield from its average value for each of the wheat varieties: variance (2.391; 2.516; 2.625).

So, the preliminary results of comparing the yield of three experimental wheat varieties indicate that the numerical characteristics of the studied indicators in all varieties are approximately the same. For a more accurate assessment, the following steps were taken.

In the case of comparing the control group (K) and experimental (E1), we found the quantile of the Student's distribution $X_r=1{,}645$ and $X_l=-1{,}645$

and sampled value $\varphi=1{,}335$. So, the fulfillment of the inequality

$-1{,}645<1{,}341<1{,}645$ became the basis for accepting the hypothesis: the yield indicators of the three experimental wheat varieties do not differ, different results obtained in individual plots are random. Comparison of other pairs of groups was carried out similarly $\varphi=1{,}079$; $\varphi=-0{,}245$).

So, we can conclude that the null hypothesis H_0 is accepted: the yield indicators of the three experimental wheat varieties do not differ, different results obtained in individual plots are random.

$$K := \begin{pmatrix} 2 & 2 & 3 & 4 & 4 & 4 & 12 & 5 & 5 & 5 & 5 & 6 & 6 & 6 & 6 & 6 & 6 & 6 & 6 & 7 & 7 & 7 & 7 & 7 & 7 & 7 & 7 & 7 & 8 & 8 & 8 \\ 8 & 8 & 8 & 8 & 8 & 8 & 8 & 8 & 9 & 9 & 9 & 9 & 9 & 9 & 9 & 9 & 9 & 9 & 9 & 9 & 9 & 9 & 11 & 11 & 11 & 11 & 11 & 11 & 12 & 12 & 12 \end{pmatrix}$$

$$E1 := \begin{pmatrix} 1 & 1 & 2 & 4 & 4 & 4 & 4 & 4 & 5 & 5 & 5 & 5 & 5 & 5 & 6 & 6 & 6 & 7 & 7 & 7 & 7 & 7 & 7 & 7 & 7 & 7 & 7 & 8 & 8 \\ 8 & 8 & 8 & 8 & 8 & 8 & 8 & 8 & 8 & 8 & 8 & 8 & 8 & 8 & 9 & 9 & 9 & 9 & 10 & 10 & 10 & 10 & 11 & 11 & 11 & 11 & 11 & 12 & 12 \end{pmatrix}$$

$$E2 := \begin{pmatrix} 1 & 1 & 1 & 2 & 3 & 4 & 4 & 4 & 4 & 4 & 4 & 4 & 5 & 5 & 5 & 6 & 7 & 7 & 7 & 7 & 7 & 8 & 8 & 8 & 8 & 8 & 8 & 8 & 8 & 8 \\ 8 & 8 & 8 & 9 & 9 & 9 & 9 & 9 & 9 & 9 & 9 & 9 & 9 & 9 & 9 & 9 & 9 & 9 & 9 & 9 & 10 & 10 & 10 & 10 & 10 & 10 & 10 & 11 & 11 & 11 \end{pmatrix}$$

$Stdev(K) = 2.391$ $\quad N := 62 \quad M := 58 \quad \alpha := 0.1$

$Stdev(E1) = 2.516$ $\quad Xr := qnorm\left(1 - \frac{\alpha}{2}, 0, 1\right)$

$Km := mean(K) \quad Km = 7.71$ $\quad Xr = 1.645$

$E1m := mean(E1) \quad E1m = 7.328$ $\quad Xl := -Xr$

$$\phi := \frac{Km - E1m}{\sqrt{\frac{Stdev(K)}{N} + \frac{Stdev(E1)}{M}}} \qquad \phi = 1.335 \qquad Xl = -1.645$$

$Stdev(K) = 2.391$ $\quad \alpha := 0.1$ $\quad Xr := qnorm\left(1 - \frac{\alpha}{2}, 0, 1\right)$ $\quad Xr = 1.645$

$Stdev(E2) = 2.625$

$N := 62 \quad M := 60$ $\quad Xl := -Xr$ $\quad Xl = -1.645$

$Km := mean(K) \quad Km = 7.71$

$E2m := mean(E2) \quad E2m = 7.4$

$$\phi := \frac{Km - E2m}{\sqrt{\frac{Stdev(K)}{N} + \frac{Stdev(E2)}{M}}} \qquad \phi = 1.079$$

$Stdev(E1) = 2.516$

$Stdev(E2) = 2.625$ $\quad Xr := qnorm\left(1 - \frac{\alpha}{2}, 0, 1\right)$ $\quad Xr = 1.645$

$N := 58 \quad M := 60$ $\quad Xl := -Xr$ $\quad Xl = -1.645$

$E1m := mean(E1)$ $\quad E1m = 7.328$

$E2m := mean(E2)$ $\quad E2m = 7.4$

$\alpha := 0.1$

$$\phi := \frac{E1m - E2m}{\sqrt{\frac{Stdev(E1)}{N} + \frac{Stdev(E2)}{M}}} \qquad \phi = -0.245$$

Fig. 1. Mathcad working paper, which tests the hypothesis of homogeneity of student training levels

To determine the question of the relationship between two data samples presented in the form of data matrices of random variables (A and B), the covariance coefficient of the named sets of values is estimated using the built-in function cvar (A, B). To answer the question: how dependent are the data of the two samples, we determine the correlation coefficient corr (A, B).

In addition, having a set of points (experimental data), we can build a continuous curve that corresponds to the experimental dependence. For this, regression analysis is carried out, that is, the selection of function parameters for a better approximation of the experimental data.

$$N := \begin{pmatrix} 1 & 2 & 2 & 2 & 2 & 2 & 2 & 3 & 3 & 3 & 3 & 3 & 3 & 3 & 3 & 3 & 3 & 4 & 4 & 4 & 4 & 4 & 4 & 4 & 4 & 4 & 4 & 4 & 4 & 4 \\ 4 & 4 & 4 & 4 & 4 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 6 & 6 & 6 & 6 & 6 & 6 & 6 & 6 & 6 & 6 & 7 & 7 & 7 & 7 \end{pmatrix}$$

$$M := \begin{pmatrix} 2 & 2 & 2 & 2 & 3 & 3 & 3 & 3 & 3 & 3 & 3 & 4 & 4 & 4 & 4 & 4 & 4 & 4 & 4 & 4 & 4 & 4 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 \\ 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 6 & 6 & 6 & 6 & 6 & 6 & 6 & 6 & 6 & 6 & 6 & 6 & 6 & 6 & 6 & 7 & 7 & 7 & 7 & 7 & 7 & 7 \end{pmatrix}$$

corr(N, M) = 0.939 mean(N) = 4.3 Var(N) = 2.112 Stdev(N) = 1.453

cvar(N, M) = 1.89 mean(M) = 4.867 Var(M) = 1.982 Stdev(M) = 1.408

cvar(N, M) = 1.89

corr(N, M) = 0.939

$$A := (1\ 2\ 2\ 2\ 2\ 2\ 2\ 3\ 3\ 3\ 3\ 3\ 3\ 3\ 3\ 3\ 3\ 4\ 4\ 4\ 4\ 4\ 4\ 4\ 4\ 4\ 4\ 4\ 4\ 4)$$

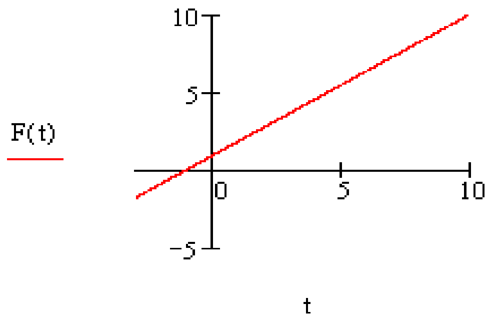
$$B := (4\ 4\ 4\ 4\ 4\ 5\ 5\ 5\ 5\ 5\ 5\ 5\ 5\ 5\ 5\ 5\ 6\ 6\ 6\ 6\ 6\ 6\ 6\ 6\ 6\ 6\ 7\ 7\ 7\ 7)$$

$$C := (2\ 2\ 2\ 2\ 3\ 3\ 3\ 3\ 3\ 3\ 3\ 4\ 4\ 4\ 4\ 4\ 4\ 4\ 4\ 4\ 4\ 4\ 5\ 5\ 5\ 5\ 5\ 5\ 5\ 5)$$

$$D := (5\ 5\ 5\ 5\ 5\ 5\ 5\ 5\ 6\ 6\ 6\ 6\ 6\ 6\ 6\ 6\ 6\ 6\ 6\ 6\ 6\ 6\ 6\ 7\ 7\ 7\ 7\ 7\ 7\ 7)$$

N := augment(A, B) M := augment(C, D)

$x := N^T$ $y := M^T$ $F(t) := \text{intercept}(x,y) + t \cdot \text{slope}(x,y)$



$$\text{regress}(x,y,1) = \begin{pmatrix} 3 \\ 3 \\ 1 \\ 0.953 \\ 0.91 \end{pmatrix}$$

s := regress(x, y, 1) A(t) := interp(s, x, y, t)

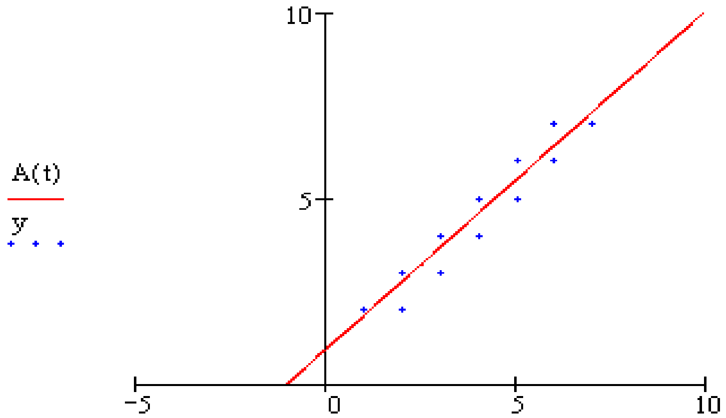


Fig. 2. Mathcad master document containing data processing to establish the nature of the relationship between success in mathematics and special disciplines

Conclusion. Thus, the introduction of Mathcad into the training system for future farmers provides the educational process with greater productivity. This process can be carried out under the guidance of a teacher or without him, depending on the level of training of the students. It is important that it is characterized by a high level of students' mental activity - creative, which, combined with the assessment and application of the information received in practice, leads to an appropriate level of knowledge assimilation. Students develop knowledge-skills that allow them to apply the received educational information in practical activities and knowledge-transformation, with the help of which the previously acquired knowledge is transferred to the solution of new problems, problems that characterize a high level of knowledge assimilation. At the same time, the content of training consists in the active search and discovery of new knowledge by students. In economic research for experimental data processing, are not only quantitative but also qualitative in nature, it is advisable to use information technology.

So, innovations in the agricultural sector need innovations in the training of future specialists, which provide for the improvement of training in the use of computer technologies both in fundamental abstract knowledge and in future professional activities.

The emergence of various systems of computer mathematics has become a means of rapid development and penetration into all spheres of human life. With the introduction of Mathcad into the process of training future specialists, it became possible, without abandoning the principles of fundamentalization of classical education, to qualitatively change the technology of professional training of specialists.

At the same time, only in conjunction with an appropriate system of educational and methodological support of the use of computer technologies gives positive results and is a step towards the fundamentalization and informatization of higher agricultural education.

References:

1. Theoretical and methodological foundations of the formation of information competencies of future primary school teachers: Author. dis .. dr ped. Sciences: 13.00.04. L.E. Petukhova; Pivdennoukr. state ped. un-t them. K.D. Ushinsky. A., 2009. 40 p.

2. Gurevich R.S. Information and communication technologies in the training of future teachers. R.S. Gurevich. O.M.Skupy. Modern information technologies and innovative teaching methods in training specialists: methodology, theory, experience, problems. Zb. nauk.prats. Issue 21 - Kiiv-Vinnitsa LLC firm "Plein Air". 2009. P.33-36.

3. Didactic conditions for the use of computer-oriented teaching aids for medical and technical students: Avtoref. dis ... cand. ped. Sciences: 13.00.09. S.N. Yatsyuk; Ox. state un-t them. L. Lutsk. 2000 . 20p.

4. Stefan I.A. Mathematical methods for processing experimental data: Textbook. I.A. Stefan, V.V. Stefan; GU Kuzbass State Technical University. Kemerovo. 2003. 123 p.

5. Mathematics and cybernetics in economics: Dictionary-reference book. Comp: I.I. Gontareva, M.B. Nemchinov, and others - ed. Second, revised. and add. M .: Economics. 1975. 700 p.

6. Beshelev S.D. and other Mathematical and statistical methods of expert assessments. M . 1974. 159 p.

7. Kudryavtsev E.M. Mathcad 2000 Pro. M .: DMK Press, 2001. 576 p.

8. Plis A.I., Slivina N.A. Mathcad. Mathematical workshop for engineers and economists: Textbook. allowance. M .: Finance and statistics. 2003. 656 p.

9. Chernyak A.A., Novikov V.A., Melnikov O.I., Kuznetsov A.V. Mathematics for economists based on Mathcad. SPb.: BHV. Petersburg. 2003. 496 p.

10. Umanets T.V., Pidgarev Yu.B. Statistics: Textbook. allowance. M. 2003. 623 p.

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