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DIGITALIZATION IN EDUCATION AS AN ENHANCING FACTOR IN TEACHING MATH

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ABSTRACT

The development of digitalization and digital technologies in Russia happens rapidly, changing the usual course of human life. The professional education system responds to current changes by adjusting to the required format, changing its goals, tasks, and learning process. This article discusses the implementation of digitization elements on the example of teaching mathematics. By introducing students to the evaluation of the relationship between random variables that underlies the study of "Big data", the authors believe that using innovative teaching methods, there is a positive dynamics to the formation of a stable cognitive interest in the subject. Students are introduced to the concept of Big data, they begin to realize that when studying various random variables, their values can be infinite arrays of data, processing of which is not possible manually.

Disciplinary: Education Science (Mathematics Education).

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1. INTRODUCTION

In order to reduce the lag in labor productivity, productivity and other indicators from countries with traditionally developed agriculture in the Russian Federation, more and more attention is paid to the development of government support measures in terms of stimulating the development of digital technologies in the agricultural sector. Currently, to meet the agricultural needs in the field of seed production and agricultural plants, the federal state information system FSIS "Seed Production" has been developed, but to address all the tasks and issues of the agro-industrial complex, a single focused service is not enough.

The Ministry of Agriculture of the Russian Federation is proposing a departmental project «Digital Agriculture», within the framework of which a set of measures is foreseen for the introduction of digital technologies and platform solutions in the agro-industrial complex. This project involves the creation and development of the national platform for digital state agricultural

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management «Digital Agriculture», the module «Agro Decisions», the industrial electronic educational environment «Land of Knowledge». In addition to creating the listed software products, the project involves the simultaneous work on training specialists of agricultural enterprises in order to build their competencies in the field of digital economy.

2. STUDY DETAILS

It should be noted that agricultural production in our country has a huge development potential, based on increasing the efficiency of land, labor and biological resources. In order to fully utilize these resources, it is necessary to improve production technologies and develop a management system based on high-level information systems. A fundamental feature of these systems is the processing of large volumes of quantitative information, the analysis of which allows to increase the efficiency of production activities, improve technological solutions and the material base of production, develop systems for processing, storage, sale, delivery of finished products to consumers (Akmarov et al., 2019).

According to experts, Russia has a significant reserve for increasing the efficiency of agricultural production (3-5 times) and the growth potential of the industry's turnover through the introduction of digital processes and technologies in crop and livestock production, increasing labor productivity and making full use of the capabilities of modern digital platforms for managing all levels of production (Akmarov et al., 2019).

Digitalization involves the accelerated development of advanced business areas, Internet trading in professional computer equipment and accessories, new working specialties, services and training functions on the use of intelligent systems in animal husbandry. We can distinguish a number of factors, both direct and indirect effects, affecting the implementation and use of digital technologies in the agricultural sector. Among the key factors affecting the development of digitalization in agriculture, we note the following:

- trade globalization;
- changing of the climate;
- the growth of urbanization;
- population growth;
- change in consumer preferences;
- development of technologies in agriculture (bio- and nano-);
- the transition from a product model to a service model and others (Volkova, 2020).

The project "Digital agriculture" would be appropriate for implementation in the Tyumen region, as it is one of the largest producers of agricultural products in the Ural Federal district. Today, Tyumen oblast is of great scientific and technological potential in various sectors of agribusiness. But still, the main driving force of social development becomes knowledge, which ensure the formation of innovative production, which involves the creation and use of new, highly efficient technological energy saving resources: machines, equipment, materials, highly efficient selection achievements, production automation on cattle-breeding complexes and farms, in processing industries APK (Ebzeev et al., 2015). And so, one of the most important factors of increase of competitiveness of development of a particular agricultural industry of the Tyumen region, as well as improving the quality of life of the population is creating conditions for innovative development of Agroindustrial complex through the introduction of digital automated technology.

The concept of innovation system and developing the fundamental mechanisms of innovation activity can be attributed to the mid 80-ies of the twentieth century. First, this term began to use such scholars as K. Freeman, B. A. Lundvall and R. Nielsen. In L. I. Abalkin, A. I. Dergunova, A. N. Illarionov, G. D. Kovaleva, Yu. p. Morozova, Yu. V. Yakovets and others addressed problems of innovative development of Russia.

Innovation consider innovative activities that have received implementation in the form of new or improved products sold in the market used in the production and processing of products. In other words, it is a vital necessity for enterprises, as their competitiveness depends on innovative development. If we consider innovation in the agricultural environment, it is a use of new technologies for the production of livestock, crops, processing of agricultural products. Innovative products increase competitiveness, make business more attractive to customers and yield high returns (Litvinenko et al., 2017).

At the present stage of development of the Russian innovation system have increased requirements for professional skills of employees of all industries (Malchukova et al., 2017). Innovation in enterprises have one important feature: to make their implementation successful and profitable, it is necessary to act strategically. The innovation process should not be disposable, it needs to be focused on the future (Epifantseva, 2019).

Innovative development of agriculture in the region requires the effective use of scientific and technical potential, integration of science, education and production, technological modernization of the economy based on innovative technologies. The solution to this complex task requires creating the right conditions: appropriate infrastructure for innovative activities or the combination of material, technical, legislative and other means, providing information, expertise, marketing, financial, personnel and other services innovation (Litvinenko, et al., 2017).

To date, such large agro-food complexes in Tyumen region as CJSC "Agrokompleks Mayak, or "Agrofirm "Kolos", or OJSC "Sovkhoz chervishevskiy used voluntary robotic milking system. This installation has allowed to increase milk production, improve milk quality, reduce the content of somatic cells in milk, and also free up professionals from the heavy manual labor. One of the innovative solutions implemented in the Tyumen region on the basis of "Agrofirma Kolos Ishimsky district is Herd Navigator – an innovative solution for herd management that automatically takes milk samples, analyses them and presents the results, allowing specialists dairy enterprise to determine the state of health of each individual cow and to make the right decision (Dronova et al., 2016). In dairy farms of the Tyumen region in 2012 in the reproduction of the herds used sexed semen. This technology allows to eliminate the problem of reduction of pedigree livestock, get healthy, highly productive Chicks, can be used as an alternative to import of heifers (update genotype) (Kayugina, 2018).

Modern society is characterized as informational, where information technology is penetrating all spheres of human life. The labour market dictates the demand for specialists, having knowledge, having experience with computer technologies (Kulikova, 2018). Currently, Informatization of society and education is a period of improvement and mass propagation of modern information and communication technologies (Otekina, 2017).

Reality and at the same time, the challenge of the modern world is the digitalization. Over the last 20 years improving the quality of education and level of teaching was the main mission of the

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Bologna process and the main goal of structural reforms in higher education of our country. Continuing education is becoming increasingly important for society, the economy and welfare of our citizens.The desire for digitalization of production within the framework of innovative development necessitated a change in training requirements.

Education is an important element of culture, which consists in a person's desire for self-development and leadership development, the ability to receive and process information, and independently make decisions in unusual situations (Nazarova, 2018). Education is a field of activity whose results are heavily reflected in the future. Education is a long process, which, according to the classifier of education levels under the Law of the Russian Federation on Education, includes pre-school, primary general, basic general, secondary general, primary vocational, secondary vocational, higher vocational, postgraduate vocational, vocational training, additional education (Iakobiuk, 2014).

Vocational education as a priority field of study requires certain changes, which reflect all advanced trends in the sphere of production, anticipating the development of a particular industry. At a time when there is a digital transformation of all industries, including agriculture, before the faculty gets difficult task: to adapt the educational environment so as to ensure the diversity and flexibility of lifelong learning, to develop competencies required in their future profession, information skills, and to eliminate barriers to the creation of open digital education.

In the digital transformation of agricultural education and economy of the agricultural sector it is necessary to introduce modern software solutions. Need a new strategy, infrastructure in the training of students of the agrarian University, management and organization of the educational process. This should be implemented in the system of higher professional agricultural education are in demand in production and business modern information technologies on their basis to develop new educational programs and training standards, control mechanisms of the system of higher agricultural education (Lemeshko, et. al., 2019). A University graduate should possess digital literacy. Digital literacy is the ability to create and use content using digital technologies, including the skills of computer programming, searching and sharing information, communication with other people (Kayugina, 2019).

The main purpose of study at the University in the framework of the competence approach is the formation and development of students together practice-oriented competences, personal qualities, and skills they need in their future professional activities. In this regard, they must have formed a level of basic training, which is necessary for solving professional problems; when studying the subsequent special disciplines profile (Biryukova, 2019).

In accordance with the requirements of new educational standards, all agricultural universities of the country in varying degrees, are implementing into the educational process the elements of digitalization. The students of the agrarian University will implement this approach during a visit to the practical and laboratory classes and during teaching practice, production, and undergraduate research. For example, in an experimental platform for research at a leading agricultural University – Timiryazev Academy is considered a digital University campus, experimental fields, Michurinsky garden, vegetable and fruit station, Timiryazevsky Park and other facilities. In their work, the students of Timiryazevka are trying to use modern information technologies for the collection, analysis and interpretation of data obtained: geographic information systems (GIS), remote sensing (RS), sensors, drones, software package ArcGIS. Current technologies of remote sensing and GIS are

appropriate and effectively used in educational and research practices to prepare scientists, agronomists in Russian state agrarian University-MTAA named after K. A. Timiryazev (Tsarapkina et.al., 2018).

The students of the State agrarian University of Northern Zauralye elements of digitalization is implemented by using

- satellite navigation systems in innovative technologies of cultivation of agricultural crops;
- systems three-dimensional design;
- numerical programmed control;
- GIS software products;
- conducting hematological and biochemical investigations, using automatic analyzer "Medonic Ca 620" and a semi-automatic analyzer "Clima MC 15";
- the use of such databases as "SELEKS", "Feed rations", ICP-FOREST, etc.

Acquaintance of students to the University of Northern Zauralye with elements of digitization begins with the first course. The implementation of the educational process takes place in a variety of disciplines, including the discipline "Mathematics". In the study of this discipline is considered the section "Correlation analysis". This section familiarizes students with the assessment of the relationship between random variables, which lies at the basis of the study of "Big data" - the designation of structured and unstructured data of enormous volume and significant variety, effectively processed horizontally scalable software tools. In the process of studying this section, students carry out design work, the purpose of which is to impart skills of analyzing the relationship between two random variables. The main stages are:

1. To provide the raw data in the form of correlation tables.

2. Calculate by definition, using the "analysis ToolPak" in Excel:

is the sample coefficient of linear correlation, set its value at significance level of 0.01, the strength and tightness;

- calculate the linear regression coefficients to write the regression equation.

3. To give a meaningful and graphical interpretation of correlation and regression analysis.

Here is an example of the tasks proposed for calculations trainees. As random variables consider X is the proportion of fat in carcass (%) and Y - specific weight of pig carcasses (%), the values of which are given in Table 1.

Table 1: Random X and Y Values

X	Y	X	Y	X	Y	X	Y
84	20	76	19	100	22	60	16
110	24	72	15	63	16	63	17
98	19	60	14	75	17	85	17
121	23	62	16	56	14	74	16
64	18	52	14	84	20	72	16
70	14	98	22	81	20	71	15
52	16	88	17	94	19	56	15
86	21	78	16	93	20	58	15
92	17	90	21	118	23	80	20
102	22	80	20	59	15	82	21

Based on the initial data, a correlation table was compiled (Table 2), in which the values of the characteristic X are presented in steps of 10, and the values of the characteristic Y are presented in steps of 2.

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Table 2: Correlation Table

y \ x	55	65	75	85	95	105	115	125	n_y
15	8	2	6						16
17		2	1	1					4
19			3	4	4				11
21				3	2	1			6
21						1	1	1	3
n_x	8	4	10	8	6	2	1	1	40

Determining the required values in the first way, that is, by definition, students receive rather cumbersome calculations. The sample linear correlation coefficient R is calculated

$$R = \frac{\overline{x \cdot y} - \bar{x} \cdot \bar{y}}{\sigma_x \cdot \sigma_y} \quad (1),$$

where the numerator of the fraction contains the average values of the average values and the average value of their product, and the denominator contains the average square deviations of random variables.

Get the value of *R*=0,83, therefore, correlation between the percentage of fat in carcass (%) and specific gravity of pig carcasses (%) is high. The sign of *R* is positive, therefore, direct communication, that is, an increase in the proportion of fat in carcasses, the proportion of pig carcasses also increases.

Install the significance of the correlation coefficient. For this we use a student t-test. For its application, we calculate the observed and tabular (critical) value of the criterion. Get $t_{observed}$=9.2 and $t_{critical}$=2.7. Compare tнабл and tкрит. As of 9.2 >2.7, then the calculated value correlation coefficient is different from zero significantly and, therefore, with a probability of 0.99 it can be argued that the studied random variables are linearly correlated.

After performing the necessary intermediate calculations we obtained the following linear regression coefficients $\rho_{y/x} = 0.17$ and $\rho_{x/y} = 4.08$. Then the linear regression equations will have the form $\overline{y_x} = 0.17x + 4.24$- linear regression equation *Y* on *X* and $\overline{x_y} = 4.08y + 6.87$ - linear regression equation *X* on *Y* will produce a meaningful interpretation of the results of the correlation analysis. Between the percentage of fat and a specific gravity of pig carcasses there is a strong direct linear correlation (R=0.83). It is possible to assert with a probability of 0.99.

Equation $\overline{y_x} = 0.17x + 4.24$ characterizes how the average specific weight of a pig carcass depends on the proportion of fat. Linear regression coefficient ($\rho_{y/x} = 0.17$) it suggests that if the proportion of fat is increased by an average of 1%, the specific weight of the pig carcass will increase by an average of 0.17%.

Equation $\overline{x_y} = 4.08y + 6.87$ characterizes how the average proportion of fat depends on the specific weight of pig carcasses. If the specific weight of pork carcasses is increased by 1%, the proportion of fat will increase by an average of 4.08% ($\rho_{x/y} = 4.08$).

Performing the task using the "analysis ToolPak" in Excel, the learner enough to bring to table cells in the source data, and use the function "Regression". In the result, we get all values required to perform the tasks, namely: the correlation coefficient (R=0.85), the parameters of the equation of linear regression Y on X (Table 3). Next, you need to record the interpretation of the results.

Table 3: Regression analysis

Regression statistics	
Multiple R	0.854
R- square	0.729
Normalized R-square	0.722
Standard error	1.535
Observations	40

Analysis of variance

	df	SS	MS	F	Importance F
Regression	1	240.39	240.39	102.048	2.57E-12
Remains	38	89.51	2.36		
Subtotal	39	329.9			

	Coefficients	Standard error	t- statistics	p-value	Lower 95%	Top 95%	Lower 95.0%	Top 95.0%
Y- intersection	6.999	1.120	6.247	2.61E-07	4.732	9.268	4.732	9.268
Variable X 1	0.139	0.0139	10.102	2.57E-12	0.112	0.168	0.112	0.168

3. DISCUSSION

Solving the task in two ways, according to the definitions and using the "analysis ToolPak" in Excel, students come to the conclusion that when processing a large sample volume results differ slightly, but the conclusions remain unchanged. But the second solution allows to save large amounts of time. Each of these ways has its advantages. Solving the problem of the first method, the trainees from the "inside" understand its essence, it helps to build their skills with different random variables. The second method only automatiseret process.

The presence of features such as "seek"; "finding solutions"; "correlation" and "regression" allows the use of standard Excel spreadsheets for workflow agronomists and other agricultural specialists (Eremina, 2017). Considering such tasks, the trainees are acquainted with the concept of "Big data" (Big data), they begin to realize that the study of various random variables, their values can be infinite amounts of data, processing of which is manually not possible.

Speaking in simple words, big data is a common name for large data arrays and methods of their processing. Such data are efficiently processed with the help of scalable software tools that appeared at the end of 2000-ies became the alternative to traditional databases and Business Intelligence solutions. Big data Analytics is carried out in order to obtain new, previously unknown information. Such an opening is called insight, which means inspiration, a hunch, a sudden understanding .

Table 4: Difference in approaches

Traditional Analytics	Big data analytics
Step-by-step analysis of small data packets	Processing the entire array of available data at once
Editing and sorting data before processing	Data is processed in its original form
Starting with a hypothesis and testing it against data	Search for correlations across all data before getting the desired information
Data is collected, processed, stored, and then analyzed	Real-time analysis and processing of big data, as it becomes available

The concept of Big data plays an important role in the process of digitalization of the economy. The main technological content of digital technology are such "advanced" and well-known approaches, such as big data and artificial intelligence technology (AI) – in connection with necessity of application of AI for big data throughout their lifecycle, and in terms of management systems and decision-making.

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Practically, it can be argued that today's big data technologies and related AI technologies not only form the core of becoming a digital economy, but also determine its main features at least in the medium term. It is important that these technologies are not socially neutral: they simultaneously offer the society new possibilities and solutions, but also are a source of grave social risk that is well understood in strategic planning.

While opportunities and risks are closely intertwined. For example, big data is considered as the digital footprint of a person, provide us with ample opportunities address client satisfaction in the here and now, possibilities emergency and personalized medical care outside of geolocation, and more. At the same time, this is a serious challenge to modern society professing the principles of privacy of the individual as an integral element of freedom (Zhulego et. al., 2019).

4. CONCLUSION

According to many scientists, and in our opinion, the use of innovative teaching methods provides a positive motivation of students to learning, promotes the formation of stable cognitive interest in the subject, improving knowledge, creates pedagogical conditions for development of abilities of students (Vinogradova et.al., 2018). All this leads to changes in the training of competitive specialists in various fields of knowledge, including the agricultural sector, and is reflected in the new educational standards of higher education.

5. AVAILABILITY OF DATA AND MATERIAL

Information of this study can be made available by contacting the corresponding author.

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