

LEASECON 2020**International Conference «Land Economy and Rural Studies Essentials»****INTEGRATION OF MATHEMATICS AND SPECIAL
DISCIPLINES IN AGRICULTURAL SPECIALTY TRAINING**

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Abstract

The scientific article examines a practical example of the integration of mathematics and special disciplines into the educational process in agricultural specialty training. As part of the research, the authors conducted the analysis of the implementation results of the business game “Logic. Model. Profession” for students in the direction 36.03.02 Zootechnics. It has been established that the competencies formed within the framework of the discipline “Higher Mathematics”, which is part of the main educational bachelor program 36.03.02 Zootechnics, are in demand among students when performing final thesis. The share of “good” and “excellent” marks was 100% in 2020, which is 13.6% higher than in 2015. The maximum level of milk production was observed in second lactation cows. Studying mathematics and professional disciplines together allows you to better develop logical thinking, as well as professional skills. Research on the topic of the article was carried out using the technical base and laboratory areas of the Department of Animal Science (Faculty of Animal Science, Commodity Science and Standardization) and the Department of Mathematical and Natural Scientific Disciplines (Faculty of Technical Service in the Agroindustrial Complex), as well as the center for collective use of scientific equipment of the Federal State Budgetary Educational Institution of Higher Education Omsk Omsk State Agrarian University named after Stolypin. The analytical data presented in this the research may be of interest to students of specialized educational institutions, as well as to those organizing the educational process in agricultural areas.

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1. Introduction

One of the primary tasks of higher education is the training of highly qualified competitive specialists, bachelors, masters capable of solving production and technological problems, and conducting research activities.

In our research, we will focus on the symbiosis of mathematics and special disciplines for the direction of training in Animal Science. Since 2017, the business game “Logic. Model. Profession” is held annually by the departments of animal husbandry and mathematical and natural sciences. The game was developed for students in the field of Animal Science, specifically for the students of the 3d and 1st years of study. In the process of approbation, the authors concluded that it is advisable to conduct training sessions in this format for students in several areas. Nowadays the business game has grown into a tradition. The unchanged participants in the game are those studying in the direction of training Animal Science (Korchinskaya, Ivanova, Shchukina et. al., 2019).

The development of metasubject competencies among students allows them to become a competent specialist in their field, capable of solving production problems at a high level.

Thus, the integration of various methods into the educational process is a promising direction that contributes to the formation of competencies in students.

The issues of using interactive forms of education are highlighted in the scientific works of Kiyko & Shchukina (2017); Polat & Bukharkina (2007).

2. Problem Statement

Mission of the Federal State Budgetary Educational Institution of Higher Education Omsk State Agrarian University named after Stolypin is aimed at creating conditions and promoting the receipt and maintenance of high-quality higher agrarian-oriented education for the rural population, as well as for the urban residents of Siberia interested in it. Therefore, all participants in the educational process are faced with the task of improving the quality of agricultural education. The relevance of our research lies in the issues of content. At the same time, the technology of teaching playing plays a significant role. The bulk of the research is devoted to gaming technology in school teaching. It is interesting to know how gaming technology will play a positive role in student learning. It is also interesting what types of didactic games will be most useful in teaching mathematics, which of them will stimulate the movement of students in educational and cognitive activities in teaching mathematics.

3. Research Questions

The subject of the scientific article is the study of the integration of mathematics into professional disciplines in training in agricultural areas.

4. Purpose of the Study

Purpose of the work: to study the impact of the use of interactive forms of teaching natural science and professional disciplines on the quality of the educational process in agricultural areas.

5. Research Methods

The object of research was the educational environment of the Omsk State Agrarian University. The article studies the practical experience of using the business game “Logic. Model. Profession” from 2017 to 2020. The article also carries out the monitoring of the quality of graduate qualification works of students who took part in the business game.

6. Findings

FSBEI HE Omsk State Agrarian University introduces students to modern research methods, to some new promising ways of developing agricultural production, which increase the efficiency of using the genetic potential of animals.

The results of mastering the bachelor's program 36.03.02 Zootechnics at Federal State Educational Standard of Higher Education are a set of universal and general professional competencies that university graduates must possess. These competencies are interdisciplinary in nature. Therefore, one of the conditions for the successful implementation of the graduate's competence model is the integration of disciplines (modules) included in the educational program.

An obligatory stage for every student of a higher educational institution is to write a final qualifying work (bachelor thesis), which combines all the knowledge and skills acquired. This work confirms the qualifications that students receive after graduation.

The graduate qualification work of students is an integral part of the final certification of graduates and is aimed at systematizing, consolidating and deepening professional knowledge and skills, as well as the effective application of this knowledge in solving specific problems in practice. The final qualifying work is the result of an independent, creative activity, which demonstrates zoo engineers being capable of creatively formulating and solving production problems. After graduating from the university, graduates can apply their knowledge in the field of planning and organizing the effective use of animals, materials, and equipment. They must be able to carry out production control of the parameters of technological processes and product quality, take part in the development of new methods, methods and techniques for breeding, feeding and keeping animals. In addition, they must be able to control and coordinate work on the maintenance, feeding and breeding of farm animals, to carry out grading and breeding selection of animals, to have the skills to develop measures for carrying out sanitary and preventive work in premises where animals are kept.

Professional competencies of graduates are based on knowledge of mathematics, computer science, chemistry, etc. As a result of mastering the bachelor's program, the graduate should have formed general cultural, general professional and professional competencies:

- ability to collect, analyze and interpret materials in the field of animal husbandry (OPK-2);

- ability to substantiate and implement modern technologies in professional activities using instrumental and instrumental base and use basic natural, biological and professional concepts, as well as methods for solving general professional problems (OPK-4);
- ability to conduct zootechnical assessment of animals based on knowledge of their biological characteristics (PK-2);
- ability to master the methods of selection, feeding and maintenance of various types of animals and technologies of herd reproduction (PK-10);

An indispensable condition for completing the final qualifying work is compliance with several requirements set forth in the main professional educational programs of specialties. Based on the results of monitoring the main professional educational programs of agricultural profile, implemented at the Omsk State Agrarian University, it was established that the calculation and analytical section is present in each program. It is not possible to complete the calculated part of the final qualifying work without using the general professional competencies obtained in mathematics courses. As a basic example, let us consider in detail the issue of using mathematical methods in the preparation of final qualification works in the direction of 36.03.02 Animal Science.

Analyzing the topics of graduate qualification works in the field of “Animal Science”, we can conclude that 75% of topics concern the issues of feeding and breeding of various species of animals, and only a third are devoted to improving the technological features of the content. Is it possible to perform animal feeding without the skills of calculating feed rations? To balance the percentage of essential nutrients? To decide on animal breeding without the ability to determine the likelihood of an event? The answer to this question is unambiguous: without the knowledge, skills and abilities obtained in mathematics, these problems cannot be solved.

Graduation qualification works of students are aimed at solving production problems in the field of animal husbandry, for example: “The influence of housing systems on the productive qualities of dairy cattle”, “Assessment of the growth and development of young cattle”. Revealing any patterns is impossible without considering many indicators. The larger the sample size, the more reliable the result will be. Thus, the use of methods of mathematical statistics in the performance of final qualifying works is an integral part of the process of performing this type of work for students.

Let us give an actual example of the integration of statistical methods of mathematics in the final certification of students in the direction of training “Animal Science”.

When analyzing the milk productivity of first-calf heifers, depending on the housing system, it was revealed that with loose housing, the milk yield for the first lactation exceeds this indicator by 175 kg or 3.15% of peers from the first group (Table 01). The reliability of the difference was 95%. There are no significant differences in quality indicators of milk productivity depending on the keeping system.

Table 1. Milk productivity of first-calf cows depending on the housing system

Index	Tied containment system (n = 453 heads)	Loose containment system (n = 527 heads)
Milk yield per lactation, kg	5548±103	5723±98
Milk fat content, %	4,43±0,02	4,44±0,01
Milk protein content, %	3,43±0,01	3,43±0,01

Thus, the maintenance system affects the amount of milk received and does not affect its quality characteristics.

The variability and heritability of traits in animals is studied by various methods. One of them is a mathematical method - biometrics, which are based on the methods of variational-statistical material. Biometrics is a branch of mathematical statistics, the science of statistical analysis of group properties in biology. Research for graduate qualification works in the field of Animal Science is based on the analysis of mass data, the object of which is a varying feature considered in a group of individuals. Study of the degree of influence on the body of various external and internal factors: feed additives, drugs, etc. It is possible using data from numerous observations, and biometrics will help to process the entire array of information.

Biometrics methods allow a graduate to give mathematically accurate characteristics of the properties and characteristics of aggregates, to reveal the degree of genetic diversity of characteristics and the influence of various factors on it, to predict the effect of selection when performing sections of the final qualifying work.

Biometrics methods are based on probability theory and the law of large numbers. Students carry out research on a sample of animals, since it is almost impossible to cover the general population. When studying the general population for the sample, i.e. the characteristic of the whole in terms of its part with a random selection of individuals, errors of representativeness are inevitable, indicating the degree of correspondence of the sample indicators to the parameters of the general population. The sampling material is primary zootechnical, veterinary, and experimental data. The student must interpret the obtained results on a sample for the general population and give his recommendations on this issue, considering the reliability of the result (Korchinskaya, Ivanova, Shchukina et al, 2019).

A business game is a form and method of teaching, in which the subject and social aspects of the content of professional activity are modeled (Korchinskaya, Ivanova, Mendziv, 2019). It is designed to practice professional skills and abilities (Popov & Babushkin, 2014). Thus, starting from the first year, the student has the opportunity to apply the knowledge gained in mathematics classes in his special disciplines, see their relationship and then apply it when writing the final qualifying work. During the game, the participants can simulate typical production situations (Newstrom & Scannel, 1997).

During our research, we analyzed the results of the state final certification of graduates of the training direction 03.03.02 "Zootechnics".

The figure shows the results of graduate qualification works before conducting training sessions in the format of a business game (2015-2017) and after (2018-2020). In general, the results of FQP defense at the Faculty of Animal Science, Commodity Science and Standardization in the direction of "Animal Science" demonstrate the prevalence of excellent and good grades (Figure 1).

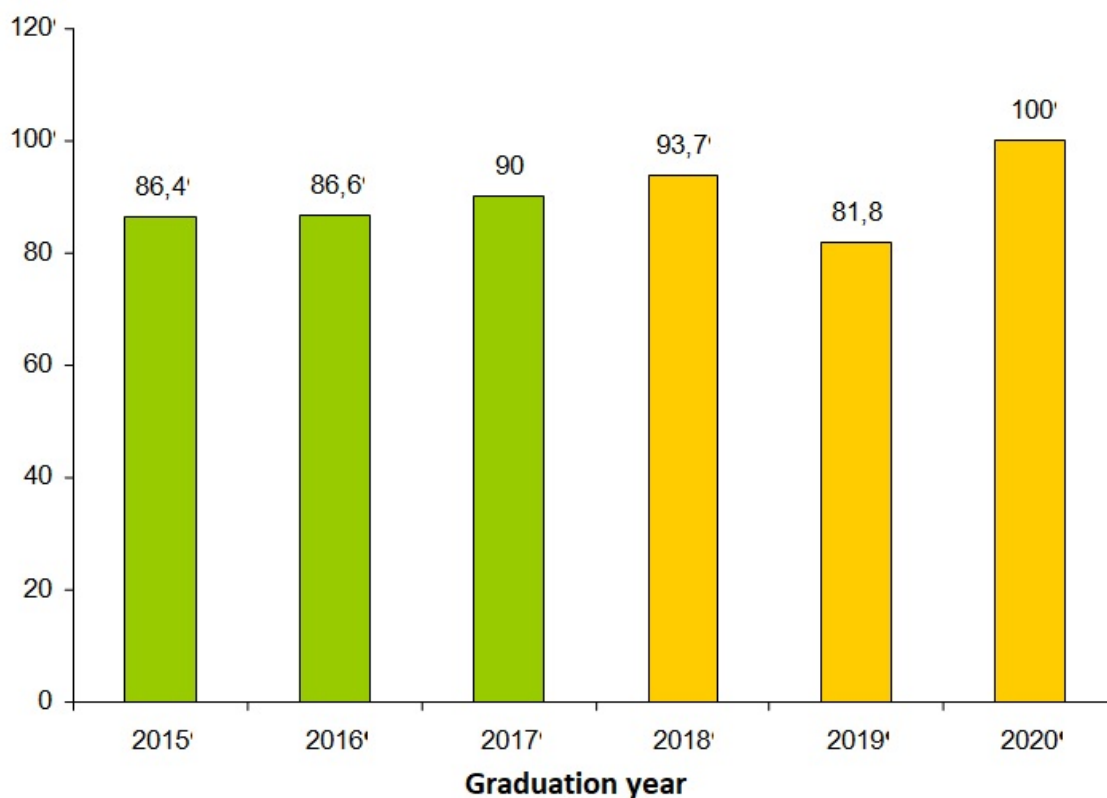


Figure 1. Quality of protection of FQP (share of theses marked “excellent” and “good”), % by the graduation year

In terms of the total number of marks, “good” and “excellent” showed almost the same results in the 2015/2016 and 2016/2017 academic years (86.43% and 86.6%, respectively). In the 2017/2018 academic year, the growth in the number of works marked “good” and “excellent” was 3.9% compared to the 2016/2017 academic year. After the business game in 2017, the growth in the number of works marked “good” and “excellent” was 4.1%. At the same time, in the 2018/2019 academic year, there was deterioration in the results by 12.7%. However, in 2019/2020 academic year the rate stopped growing and reached the highest indicator for all the studied years - an absolute 100 percent result.

Thus, the study of mathematics in conjunction with professional disciplines, the business game “Logic. Model. Profession” allows forming meta-competencies within the framework of the training of future highly qualified specialists who are able to analyze and make right production decisions.

7. Conclusion

On the basis of the research carried out and the subsequent analysis of the data obtained, it was found that during the period of active introduction of the business game into the educational process, the quality of students' knowledge has improved; the share of students who received marks “good” and “excellent” during the defense of their final qualifying work increased by 4.13%.

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References

- Kiyko, P. V., & Shchukina, N. V. (2017). Teaching methodology of econometric modeling with the help of interactive teaching methods. *International Journal of Economic Research*, 14(7), 59-75.
- Korchinskaya, O. V., Ivanova, I. P., Shchukina, N. V., & Mendziv, M. V. (2019). Business Games as a Teaching Strategy for Delivering a Practice-Oriented Course in Mathematics at Agricultural University. *Proceedings of the International Scientific Conference The Fifth Technological Order: Prospects for the Development and Modernization of the Russian Agro-Industrial Sector (TFTS 2019) Vol. 202* (pp. 355-361).
- Korchinskaya, O. V., Ivanova, I. P., & Mendziv, M. V. (2019). Business game as a method of interactive teaching in the implementation of interdisciplinary connections of mathematics and special disciplines in the preparation of students in agricultural areas. *Scientific and methodological aspects of mathematical training in universities of a technical profile: materials of the International scientific-practical Conference* (pp. 85-90) Gomel: BelSUT.
- Newstrom, D., & Scannel, E. (1997). *Business games and modern business*. Moscow: BINOM.
- Polat, E. S., & Bukharkina, M. Y. (2007). *Modern pedagogical and information technologies in the education system: a textbook for students of higher educational institutions*. Moscow: Academy.
- Popov, E. B., & Babushkin, S. S. (2014). From “Games in general” to an interdisciplinary business game. *International Journal Sustainable Development: Science and Practice*, 2(13), 184-191.