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APPLYING PROBLEMATIC METHOD TO THE FORMING RESEARCH COMPETENCE OF BACHELORS OF AGRARIAN SCIENCES DURING THE STUDYING OF MATHEMATICS

Анотація

В статті теоретично обґрунтовано необхідність формування дослідницької компетентності бакалаврів з аграрних наук. Обґрунтовано доцільність застосування проблемного підходу при вивченні математичних дисциплін для спонукання бакалаврів з аграрних наук до самостійної діяльності як одного з основних факторів формування дослідницької компетентності. Продемонстровано доречність використання проблемного навчання при вивченні математичних дисциплін, що характеризує зону найближчого розвитку і дозволяє викладачу окреслити коло найближчих проблем, з якими стикаються студенти. Показано роль задач у навчанні математичним дисциплінам при застосуванні проблемного підходу та наведені приклади таких задач. Також продемонстровано необхідність пропонувати бакалаврам з аграрних наук найбільш універсальні, загальні методи розв'язування математичних завдань, забезпечуючи таким чином тісний взаємозв'язок різних розділів курсу і систематичне об'єднання аналітичних, геометричних та обчислювальних методів. Встановлено, що за допомогою проблемних ситуацій відбувається спонукання бакалаврів з аграрних наук до самостійної діяльності. Показано різні шляхи створення проблемних ситуацій. Розглянуті функції проблемної ситуації та визначена її методична структура, яка детально розкрита. Описані основні етапи розв'язування математичних завдань та обґрунтовано їх послідовність в умовах проблемного навчання, виявлені компоненти цих етапів. Встановлено, що при вирішенні проблемних завдань виникають суперечності, які становляться причиною формування дослідницької компетентності у бакалаврів з аграрних наук. Названі основні умови, яких має дотримуватись викладач під час створення проблемних ситуацій. Зроблено висновки, що при розв'язуванні бакалаврами з аграрних наук проблемних завдань з математичних дисциплін непомітно відбувається перехід від пасивного засвоєння інформації до формування якостей, необхідних для формування дослідницької компетентності.

Ключові слова: проблемний підхід, проблемне навчання, проблемна ситуація, самостійна діяльність, дослідницька компетентність, математичні дисципліни, бакалаври з аграрних наук.

Annotation

The article theoretically substantiates necessity of the forming research competence of bachelors of agrarian sciences. The expediency of applying

problematic method during the studying of mathematics for motivating bachelors of agrarian sciences for self-sufficient activity as one of the main factors of forming research competence has been justified. The reasoning of using problematic studying during the studying of the mathematics, that characterizes the area of the closest developing and gives the teacher the way to find out the area of the closest problems that students face, has been demonstrated. The value of problems in the studying of mathematics during the usage of problematic method has been shown, and the examples of such problems has been given. Also the necessity of giving the agrarian bachelors the most universal, general methods of solving math problems has been demonstrated, giving close interaction different parts of the program and systematic combining of the analytic, geometric and calculative methods. It is researched, that problematic situations make agrarian bachelors do independent activity. Different ways of creation problematic situations have been shown. Functions of problematic situations have been reviewed, and it's detailed methodic structure is established. Main steps of solving mathematics' problems have been described, and their order under the conditions of problematic studying have been justified. Main components of those are found out as well. It has been established, that during the solving problematic tasks, certain contradictions appear to become the reason of forming research competence. The main conditions, which lecturer is to stick to during the creation of the problematic situations are listed. As a result, bachelors, during the solving of problematic situations in mathematics, insensibly shift from the passive consuming of the information to forming the qualities, that are required to forming the research competence.

Key words: problem approach, problem education, problem situation, independent activity, research competence, mathematical disciplines, bachelors in agrarian sciences.

Formulation of the problem

Nowadays the knowledge isn't the main part, that higher education is oriented on. It depends on the constant acceleration of the scientific and technical progress, which make scientific research constantly increase, sometimes change, sometimes even radically. This makes the knowledge in modern world less worthy than skill of seeking it and using it professionally.

That's why a university lecturer has to be flexible to needs of society, adaptive to new ideas, technologies, possess deep knowledge in wide range of modern innovative technologies and effective methods, in particular problematic studying. The lecturer has to find technologies helping the students seek new knowledge independently from different sources, form their own points of view, know how to formulate it.

Problematic studying creates the possibility to help subjects develop the abilities to self-educate, self-define, self-realization and independence.

Due to organization of studying activity in high school, nowadays scientists have developed wide range of scientific methods. Problematic method require special attention, because it, as we presume, help the forming research competence of students, particularly agrarian bachelors during the studying of disciplines of math cycle. The lecturer has to create a problem and in a way of a formulating right questions make it solved.

Up-to-date research analysis

Many math scientists in different times agreed, that the prepared knowledge shouldn't be given to the students. The problematic method was used even in Ancient Greece, a homeland of many westers education traditions.

In pedagogical science interest for the problematic studying appeard in the 20-30s of previous century, and was reborn at the new stage in 60-70s. A large number of psychological, pedagogical and methical research was devoted to it.

Fundamental parts of the concept of problematical studying were in different times developed by T.Kudryavcev, I.Lerner, A.Matyushkin, M.Makhmutov, N.Merchinska, U.Okon, M.Skatkin, N.Talizina, I.Yakimanska etc.

Integrating the problematic studying under the condition of higher school were the subject of researches by S.Archangelskiy, V.Andreyev, Y.Kulyutkin, T.Ilyina, A.Aleksyuk, etc. Sone forms of problematic studying were researched by M.Artyushina, V.Manko, A.Furman, N.Yantz, etc.

The theory of problematic studying of math was made and developed with a purpose of applying to general secondary education. It is obvious, that the method of problematic studying in a higher school has it's own specific, connected to different purposes and challenges of professional studying, differences in age and motives of different students of secondary and higher school. Also it is necessary to make clear the specific trait of the study process in higher school – system of lectures and seminars instead of lessons.

The purpose of the article

The purpose of the article is to justify reasoning of usage problematic method while studying mathematics to motive agrarian bachelors to self-educating as the main factor of forming the research competence.

The presentation of the main material

Nowadays the relevance of the problematic methods hasn't decreased. Because the problematic methods caused by level of society developing, it surely has acquired new shades. A problematic situation in studying is a learning difficulty, solving which require the students the acquiring of new knowledge or implementing intellectual effort.

So one of the most important task of problematic studying is the necessity of as clearly as possible distinguish things that students already know from things they only believe to know. In accord with methods of problematic studying on the previous stage the lecturer make the verdict about the

individual abilities of the students in both questions they discover during the discussing and mistakes they make answering questions or executing learned actions. It is important, because mistakes show not only lack of knowledge and skills of the students, but also their abilities, and so characterize the area of the closest problems, which student are able to understand.

A problematic situation can appear during the studying the theoretical material as a result of discovering a contradiction between the new data and knowledge and beliefs, which students formed from previous experience. In this case the lecturer's task is to lead students to a necessity of implying new concepts to remove contradictions.

Let us dwell on the structure of the discipline, since it predetermines the possibility of disclosing all the problematic topics for which training and the potential for students to acquire the necessary competencies are expected. The modular system for constructing the process of teaching discipline in higher education institutions is a new, but highly successful form of organization of the educational process aimed at the formation of professional and general cultural competencies of a graduate bachelor.

Today, under the conditions of active innovative development of agriculture, graduates of agricultural universities should have the following general mathematical competencies: 1)possession of mathematical culture of thinking, the ability to generalize, analyze, perception of information, setting goals and choosing ways to achieve it; 2) the ability to logically correctly reasoned and clearly build mathematical oral and written speech; 3) willingness to cooperate with colleagues, work in a team; 4) the ability to independently acquire and use in practice the mathematical knowledge and skills, the desire for self-development.

As a result of the analysis of professional competencies, a graduate should possess the following applied mathematical competences: 1) the ability to use the basic laws of mathematical disciplines in their professional activities, to integrate knowledge from different sections of the course of mathematics; 2) the ability to apply analytical, computational methods for solving applied problems in the field of agriculture; 3) the ability to make science-based decisions on the basis of mathematics, to carry out the formulation and carry out experiments to verify their correctness and effectiveness; 4) the main provisions, laws and methods of mathematics; the ability to identify the natural-science essence of the problem arising in the course of a professional activity, the readiness to involve the corresponding mathematical apparatus for solving them; 5) the ability to develop and apply a mathematical model appropriate to the process in the course of professional activity.

The iconic trait of teaching agrarian bachelors the mathematics is tasks as the main part. Traditional functions of tasks are mastering the system math knowledge, scientific conscience, research competence, activating self-sufficient learning activity.

Nowadays increasing of amount and difficulty of the studying information is accompanied with decreasing amount of math learning hours. Under such conditions traditional functions of practical tasks are accompanied by a function of an information carrier, which means that theoretical parts are told and mastered via tasks. This is one of the types of problematic situations, when a problematic situation is made by formulating theoretical statements as tasks, dealing with which requires transformation available knowledge and skills, finding out new fields of using them. This is the way of actualizing the main purpose of studying, which is moticating students for independent activity.

Let us study few examples.

Example 1. During the subject "Multiplying the matrices" in the part "Linear algebra" the lecturer introducing students to the rule of multiplying matrices. Then, as a known rule, they find the result with given matrixes A*B. Let A and B be square matrices of second order. Then the lecturer suggest the students finding the result of matrices B*A. As a result of solving the example students make the conclusion, that the law of transpositioning the matrices does not work.

Example 2. After studying the part "Elements of vector algebra" students study the part "Elements of analysis geometry". In this case studying analysis geometry can be considered as the addition to vector algebra in solving the following tasks: result of the equation of the plain, going through the point, perpendicular to the given vector; equation of the plain going through three given points; canonic equations of the straight lane in space, etc. Using such method students learn the general method of acquiring results of the equations.

Example 3. Taylor series is being studied as a result of solving the task of dividing the function into the range of degrees. During the solving of the task students make their own way to Taylor series, find out the conditions of dividing the function into the Taylor series and justify unity of such dividind.

Example 4. During the studying the subject's "Retests" part "Main possibility theories and the elements of math statistics" the lecturer introduce the students to the Bernoulli formula, and fasten it with a task of the following kind: six animals have a disease, and the possibility of a restoration is 0,98. What is the possibility that four animals of six restore? Then students are asked to find the possibility of 200 of the sick animals to restore, if the possibility of restoration is 0,98. As a result of creating a problematic situation students find out, that in large amount of tests (300 animals) using of Bernoulli formula is problematic, and alternative way is required. To be exact, it is using of de Moivre–Laplace theorem.

During the studying of the mathematics it is useful to offer the students most universal, general methods of solving the tasks, creating close interaction

of different parts of the course and systematic unification anylytic, geometric and calculation methods.

Problematic situations are created also in the way of making analogies between the properties of known objects and using the generalities to implement new objects and concepts.

For example similar properties of operations of adding and multiplication in different pluralities (vectors, matrices, functions) allow to add the general definition of linear space.

Principally new possibilities of creating problematic situations are made with using of so-called reversed scheme of studying, the way of classes, when students come prepared, having fulfilled the previous home task, given by the lecturer.

As the experience shows, sometimes it makes sense, if a practical class is prior to a lecture. Then the students can be prepared to understanding theoretic material, offered relevant tasks, including practical ones.

During the studying process, problematic situation execute functions as:

1. Being the initial part of the process of acquiring (creating the motive of learning)
2. Creating the main conditions of studying process,
3. Being the main way of controlling studying process.

All ways of problematic studying are traditionally split into two steps (except preparation): giving a practical or theoretical task, which reveals the problem itself; seeking the unknown part of the situation in a way of independent research or research with a lecturer.

The methodical structure of solving the problematic situation defines four common steps of solving the tasks:

1. Analysis of task condition;
2. Making a plan (algorithm) of solving;
3. Realizing the plan;
4. Studying the result.

With such dividing first two steps are bound to orienting part of student's activity during the process, the third is executive, the fourth is the control one.

In a traditional studying the main part is the third (executive) step, the orienting part is lacking attention and time, and the fourth step, studying the result, is almost absent.

In a contrary, the problematic studying the main attention is given to the first two and the fourth steps, that helps forming research competence. The last step is the control part of the activity, and can include the following components: justifying the result, including checking the used algorithm and the result itself; discussing the question about optimality of the chosen algorithm; finding out new knowledge, skills and abilities, acquired as a result of solving the task (or several of tasks). The fourth step is reasoned to add with

a discussing of a possibility of practical implementing new knowledge and abilities in solving study, research and professional tasks.

So, the problematic tasks principally differ from training. During the solving, some contradictions may appear and become the reason of forming research competence of agrarian bachelors. Solving the math problems today will grow into an ability of making the decisions, acting correctly and overcome life difficulties. The task of the lecturer is to persuade students to search on their own. Then the work on pre-made pointing will be considered as uninteresting.

During the making problematic situations the following conditions are necessary:

1.   Lecturer is to offer the students such theoretical or practical tasks, which help them acquire new knowledge, based on pre-studied material;

2.   Problematic tasks are to be doable for students, to be difficult enough, but at the same time possible for solving with basic pre-formed skills, mastering them in general way and sufficient level of knowledge;

3.   If students in problematic situations weren't able to solve it, the lecturer is to formulate a problem they faced, point at the reasons and explain required material.

After solving the problem situation, explaining the material by the lecturer is extremely important. It needs t o be done after the questions of the students, which may appear in the problematic situation. In the practical class students must at first acquire and then use required theoretical knowledge or skills for solving the task. If the problematic task is rather hard, it can be separated into several problematic task in order to make it possible for students.

Developing of the individual thinking depends not only personal experience of solving the tasks, but also observation other students working on their tasks.

Conclusions

During the solving problem mathematical tasks happens the unnoticed shift from the passive data acquiring to forming the qualities, necessary for the forming research competence. One mustn't forget that the main task of the mathematical education is the developing of creative personality, which is able to constant self-developing. The skill of solving mathematical problems now will help in research activity, flexibility of the mind later.

Possessing of such abilities is an important factor for the future specialist, because with increasing the level of society developing the requirements will increase as well. Thanks to the acquirements during the student years a person can study, acquire new data, create and be useful for the society for a lifetime.

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