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Research Article

TYPICAL MISTAKES OF STUDENTS IN ANALYTICAL GEOMETRY AND DIAGNOSTICS OF THE CAUSES OF ERRORS

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ABSTRACT

Typical mistakes of students in analytical geometry and diagnostics of the causes of errors. The practice of teaching analytical geometry for bachelors in mathematics in higher education.

KEYWORDS

Analytical geometry, mathematics, diagnosis, important, techniques, provides. (buniyam bir ko'z tashla).

INTRODUCTION

An analysis of the practice of teaching analytical geometry for bachelors of the direction of mathematics in higher educational institutions showed that in the methods of working on errors that are currently being carried out, there is no fundamentally important, from a psychological point of view, link - the diagnosis of the causes of errors, which can be carried out by activating the reflective activity of students ...

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The established system of teaching mathematics in a higher educational institution (in particular, analytical geometry) pays little attention to the process of formation of students' reflective activity and its use in the work to prevent mathematical errors. Methodists offer various approaches to eliminating the causes that are sources of errors, offer various methodological systems (techniques) aimed at preventing erroneous reasoning. However, university professors are indifferent to scientific and methodological achievements. This can be explained by the fact that, as a rule, the proposed new methodological systems (techniques) are laborious and require a large expenditure of study time, which should not be allowed. In the plans of some teachers no special work is provided for the wide and purposeful use of reflective activity, which would be aimed at identifying, researching and correcting mathematical errors by the students themselves. It is known that independent work of students on mistakes provides a more conscious analysis of them and analysis of their own actions to solve a specific problem, which has a beneficial effect on the quality of the knowledge gained and stimulates the development of logical thinking.

THE MAIN RESULTS AND FINDINGS

The results of psychological research (B.G. Ananiev, D.N.Bogoyavlensky, N.P.) made it possible to conclude that in more than 24% of students the actions that provide clarification of the reasons for the mistakes made are either not formed at all, or are insufficient. perfect. Therefore, the causes underlying the occurrence of errors remain unresolved. In scientific and methodological works, in general, recommendations are offered to teachers on how to eliminate errors, and only a small number of works are devoted to research on students' independent work on errors. (E. D. Bozhovich, O. N. Yudina and others). These works investigate the methods of forming students' self-control, which is increasingly becoming the subject of psychological and pedagogical research (BC Kramor, A.S. Lynda, S.G. Manvelov, G.A. Mor, V.I.Stepansky, etc.) and consists in the analysis and regulation by students of their own educational activity, being at the same time a means of its control and correction of the noticed mistakes. Many scientists (Hans-Dieter Hopfner. Nazhmiddinova N. 3. Otamirzaev O. U., Zokirova D. N., Vakhobova S. K. BC Kramor, SV. Krivykh, L. K. Maksimov, etc.) self-control, self-esteem are considered elements of reflective activity. Agreeing with the opinion of B.A. Dalinger, by reflexive activity we mean the mental activity of students, aimed at understanding their positions, at finding the causes of difficulties arising in solving problems, at formulating rules and criteria that can be guided when building a model of new activity.

The study of the possibilities of using reflection in educational activities is the subject of the works of M.E. Botsmanova, V.A. Dalinger, A.V. Zakharova, L.K. Maksimova, G. D. Tonkikh and others. In the opinion of many authors, reflection regulates the process of finding a solution to a problem, stimulates the advancement and change of hypotheses, and ensures the correctness of their assessment. But in these works, the possibilities of using the reflective activity of students in work on mathematical errors are not thoroughly investigated.

Consequently, there is a need to find ways to form and develop the reflective activity of students to prevent typical mistakes by means of special techniques, various forms of organizing educational work.

MAIN PART

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The result of many years of work, the analysis of research carried out in recent years of teaching analytical geometry, showed that it is possible to activate the reflexive activity of students with the help of special (reflexive) tasks, but textbooks on analytical geometry lack a sufficiently complete system of tasks that contributes to the formation and development of reflective activity in error prevention. The need to actualize reflexive activity in solving problems is that students gradually develop the desire and ability to understand the problem, plan its solution, think over possible options for action and predict their results. It is known that students are far from always able to independently identify various situations in educational activity that require the active use of reflexive activity, and therefore they should be identified by the teacher and given to students as special tasks that require specific mental activity from them. Thus, the problem of developing and including a special system of tasks that forms and develops the reflexive activity of students into the methodological system of teaching analytical geometry is urgent; a specially developed technique that includes all the actions necessary to identify an error, analyze it and correct it, which activates reflexive activity.

The course in Analytical Geometry is quite difficult and leads to a number of problems. For example, a large number of students' mistakes when solving problems in analytical geometry is the result of insufficient attention to the argumentation of reasoning, too early loss of the justifying component in the formation of the ability to apply this or that rule, and there are a large number of them, as the analysis of textbooks has shown . The algorithmic nature of the analytical geometry course, unfortunately, contributes to the formal assimilation of the rules, techniques for solving typical problems, etc., which increases the likelihood of making a mistake. Repeated use of a certain rule in solving standard problems leads to its formal assimilation, which adversely affects the quality of students' knowledge. It is known that the awareness of the rule either determines the actions, or at least controls them. Knowledge of the rule is also necessary in order to verify the decision and give its justification. But most students perceive an Analytical Geometry course as a set of unrelated rules that they learn to apply to problem solving. To solve this problem, it is necessary to develop a model for teaching rules through a system of tasks using a technique that activates the reflexive activity of students to prevent typical errors that arise during their application.

The problem of the formation and use of the reflective activity of students in the process of teaching analytical geometry can get a fundamentally new solution if it is possible to find such a methodological support for students' activities that would allow for research and corrective work on errors.

Thus, there is a contradiction between the need to organize systematic work on the formation of students' reflective activity, aimed at preventing typical mistakes in the process of teaching analytical geometry, and insufficient development of the corresponding didactic means. The search and development of effective didactic tools and techniques that allow the formation and development of students' reflexive activities aimed at preventing mistakes seems to be a fairly urgent methodological problem.

Although the problems of the formation and development of reflective activity in the learning process and the search for new forms of work on students 'mathematical errors are not completely new, the study of such an aspect as the use of students' reflective activity when working on typical errors in scientific research has practically not been considered.

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Based on the research of V.A. Dalinger, we gave a brief description of the reasons for the mathematical errors of students in general and the characteristics of these reasons, taking into account the specifics of the course in analytical geometry, and determined the composition of corrective actions:

1) Fixing the student's attention to the error and its analysis;
2) Identifying its cause;
3) Identification of the necessary corrective action;
4) The use of corrected knowledge and actions in the process of solving similar problems.

The second action is exploratory in nature and can be described as follows:

- Reproduction (awareness) of one's own actions, which led to an erroneous decision;
- Building on the basis of theoretical knowledge of the reference variant of actions to solve the problem;
- Comparison of own actions with the standard and detection of inconsistencies in them;
- Conclusion about the causes of the error.

Taken together, all these actions are stages of the process of self-control, which, according to some scientists, is an element of reflexive activity. Therefore, the paper considers the issue of the relationship between self-control and reflexive activity of students, aimed at preventing and correcting mathematical errors; the main approaches to the definition of reflection are systematized, the methods of its formation and development in the educational process are described; the special role and possibilities of algebra in the development of the reflexive activity of students are indicated.

Highlighted new types of reflective activity that are formed in the process of solving problems. Reflection of search, which manifests itself in the process of finding solutions to problems or problems. It consists of:

Reflection of the psychology of finding a solution - an analysis of one's own behavior, one's own activity in solving a problem.

Reflection on the technology of finding a solution is the choice or awareness of a strategy for solving a problem.

The student compares and compares the conditions and requirements of the problem with the knowledge he has, correlates them with the mastered methods, schemes, and methods of activity. Reflection of the logic of the search for a solution - the choice of a driving motive, through highlighting the main thing, as well as through the very formulation of questions aimed at conducting a qualitative analysis of the problem. Reflection of the search for a solution - analysis of the course, solution; control over the implementation of the planned solution plan; abstraction and schematization of the obtained solution; assignment of results to the requirements and conditions of the problem. All actions performed by students when solving a problem and activating one or another type of reflexive activity must be consistent, reasonable, rational, etc. Therefore, during the formation of reflexive activity, the development of such indicators of logical thinking as criticality, breadth, flexibility occurs. In this regard, the requirements for the system of tasks are described, the solution of which contributes to the development of the ability to reason, fosters the conviction in the need for argumentation of the performed (performed) actions, etc.

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For a more effective formation of an action that is aimed at investigating an error, a significant characteristic of the technique being formed is the student's awareness of those actions that make up the operational component of the research-corrective technique of working on errors. It is important that the new technique for correcting errors is characterized by a high degree of generalization. In this case, the likelihood of using it in situations other than those in which it was formed increases.

To develop the ability to solve problems, we made recommendations for students on solving mathematical problems, contributing to the formation of search reflection, which were actively tested in the process of experimental learning.

To solve problems, students often have to apply one or another rule, of which, as the analysis of textbooks has shown , there are a large number of them in the course of analytical geometry. Therefore, we have developed a model for teaching rules, in which much attention is paid to the prevention and correction of errors through the use of a research and corrective technique that activates the reflective activity of students (which is one of the directions we have developed for methodological work on students' mathematical errors). Note that each topic of the course in Analytical Geometry can be studied using this model. We use the model to solve the following problem.

Task. The side of the rhombus is 5 cm, its height is 4.8 cm. The ellipse passes through two vertices of the rhombus, and the foci of the ellipse lie on the other two vertices of the rhombus. Write the equation for the ellipse.

To solve the problem, you need not only knowledge about the ellipse and knowledge about the rhombus. This task requires logical thinking. If the sides of the rhombus are 5 cm and the height of the rhombus is 4.8 cm, then the area of the rhombus is

$$S = ah = 5 \times 4{,}8 = 24 \quad (\text{cm}^2).$$

On the other hand, the equalities

$$d_1^2 + d_2^2 = 4a^2 \qquad (1)$$

and the area of the rhombus

$$S = \frac{d_1 d_2}{2}$$

Then

$$24 = \frac{d_1 d_2}{2}$$

$$d_1 d_2 = 48$$

From the last $d_2 = \frac{48}{d_1}$

Substituting the found value into (1), we obtain

$$d_1^2 + \frac{48^2}{d_1^2} = 4 \times 25$$

Or

$$d_1^4 - 100 d_1^2 + 48^2 = 0$$

Solving this biquadratic equation, we have

$d_1 = 6$ or $d_1 = 8$

and

$d_2 = 8$ or $d_2 = 6$

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dianals of rhombus 8 and 6 or 6 and 8.

If the length of the diagonal of the rhombus is 8 cm, then if the ellipse passes through the vertices of the rhombus, then a = 4, and the foci of the ellipse are at the other two vertices of the rhombus, i.e.

$$c = \frac{d_1}{2} = 3$$

Then from the formula $b^2 = a^2 - c^2$

We find

$$b^2 = 4^2 - 3^2 = 7$$

Then the equation of the ellipse has the form

$$\frac{x^2}{16} + \frac{y^2}{7} = 1.$$

Second solution. If the foci of the ellipse are located along the diagonal 6 , here only $b^2 = 3^2$, since if we assume then

$$a^2 = 3^2$$
$$b^2 = 3^2 - 4^2 = -7$$

doesn't make sense. Therefore , $b^2 = 3^2 = 9$the foci of the ellipse are at other vertices of the rhombus: c^2=16 and

$$a^2 - c^2 = b^2$$

From the formula we find

$$a^2 = 4^2 + 3^2 = 25.$$

Then the equation of the ellipse has the form

$$\frac{x^2}{25} + \frac{y^2}{9} = 1.$$

The rule we are describing cannot be implemented minimally; students need to consistently perform all the actions that are part of it. The detailed implementation of the rule is accompanied by constant monitoring of each step of the actions performed, analysis of the reasoning being conducted, which forms the reflexive activity of students.

Using specific examples, the author examines the mistakes made by students when solving equations and inequalities, and methods of preventing and correcting them using a research-corrective method of working on errors. We have divided the typical mistakes students make when solving problems of the second-order line into four groups, which, with a more careful analysis, can be divided into smaller subgroups. The first group of mistakes are mistakes that are made in determining the type of a second-order line during its transformations, or those that have occurred as a result of the fact that students pay insufficient attention to finding it. In the second group of errors, we combined those that are committed as a result of incorrect reasoning when solving a problem (parallel transfer containing a variable, reducing the general equation of a line to the canonical form, etc.). We considered it necessary to group these errors into a separate group, since they are the most common. The third group of mistakes - mistakes made by students due to the fact that they do not have the proper level of knowledge of theoretical positions.When solving problems for the study of the general equation of a second-order line, students make mistakes, establishing an erroneous analogy with equations

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In the course of the research, the following tasks were solved:

- Determination of the level of formation of the reflexive activity of 1st year students in teaching analytical geometry;
- Identifying the causes of typical errors, determining ways to prevent them, analyze and fix them.

CONCLUSION

As a result of written work among 1st year students of Fergana State University, oral surveys of students, conversations with teachers of this university and their questionnaires, the levels of formation of the reflective activity of students, manifested in solving problems, were determined and described.

In order to identify the level of formation of reflective activity, written work was carried out (tasks were selected according to the objectives of the study) among 1st year students (67 students). The results of written works allowed us to conclude about a low level of formation of the reflective activity of students and led to the conclusion that it is necessary to create conditions for its formation and development, namely, for the use of reflective activity in working on mathematical errors.

At this stage, the following tasks were solved: identifying the possibilities of the analytical geometry course in the formation and use of reflective activity to prevent typical mistakes

How I acted How I should have acted Why I was wrong Classes were held, training in which was distinguished by the use of a specially developed system of tasks aimed at developing the reflective activity of students to prevent errors. In addition, an assessment of the level of formation of students' indicators of logical thinking was carried out, since at the stage of the ascertaining experiment, a theoretical assumption was made that experimental learning would contribute to the development of such indicators of logical thinking as criticality, breadth, flexibility.

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