Список использованной литературы

1. Алексашина, И. Ю. Формирование и оценка функциональной грамотности учащихся: Учебно-методическое пособие / И. Ю. Алексашина, О. А. Абдулаева, Ю. П. Киселев; науч. ред. И. Ю. Алексашина. – СПб. : КАРО, 2019. – 160с.
2. Сазанова Л. А. Ментальные карты как средство обучения в вузе / Л. А. Сазанова // Перспективы развития информационных технологий. – 2016. – № 28. – С. – 118–122.
3. Хакимов Д. Р. Применение в учебном процессе ментальных карт / Д. Р. Хакимов // Образовательные ресурсы и технологии. – 2016. – № 1. – С. 3–8.
4. Пирютко, О. Н. Методика преподавания математики учебное пособие для студентов, магистрантов, учителей / О. Н. Пирютко. – Мiнск : Народная асвета – 2023. – 304 с.
5. Пирютко, О. Н. 60 уроков стереометрии – 10 класс // О.Н. Пирютко, А. А. Черняк, И. Г. Арефьева. – Мн. – Народная Асвета. – 2022. –166 с.
6. Видеуроки: грант [Электронный ресурс]. Режим доступа: https://drive.google.com/drive/folders/1pWd-10lBOxJx22nJ7j3Br52WGhC5sOdK. Дата доступа 12.10.2023.

УДК 372.851

А. А. Папышев
A. Papyshev
Казахский национальный педагогический университет имени Абая
(Алматы, Казахстан)

ПРИМЕНЕНИЕ ВЕКТОРНОГО МЕТОДА ДЛЯ РЕШЕНИЯ МАТЕМАТИЧЕСКИХ ЗАДАЧ

TEACHING STUDENTS TO SOLVE MATHEMATICAL PROBLEMS USING THE VECTOR METHOD

В статье раскрывается аналитический метод решения планиметрических задач по геометрии в контексте деятельностного подхода, приводятся соответствующие примеры.

The article reveals an analytical method for solving planimetric problems in geometry in the context of the activity approach and provides relevant examples.

Ключевые слова: задача; метод; деятельностный подход; модель; решение задач.

Keywords: task; method; activity approach; model; problem solving.

Mathematical education is the main element of secondary education. The reform of mathematical education, which began in the Sixties, and is still changing annually, is accompanied by the introduction of the of modern and rational methods of problem solving into the geometry school course. A new quality of teaching non-traditional geometry for the school course by the method of solving problems requires the development of appropriate methodological support for the educational process. The analytical method of solving a geometric problem is usually understood as a method of solving it, in which analytical relations act as a formal mathematical model. We will confine ourselves to considering the method of teaching an unconventional vector method of solving problems for the school course in the context of the activity approach. The vector method of solving problems meets all the criteria of leading knowledge, but the practice of their application in the study of planimetry in existing textbooks and manuals does not correspond to their methodological significance. We proceed from the need to harmonize the methodological significance of the vector method of solving planimetric problems with the practice of teaching the latter. The vector method enriched algebra with geometric clarity, made it possible to present the course of various processes in visual geometric images. The same problem receives a different vector representation depending on a particular way to solve it. The vector method is effective in: a) proving the parallelism of lines and segments; b) substantiation of the statement about the division of the segment by this point in this respect; c) finding out the ownership of three points of the same line; d) proving the perpendicularity of lines and segments; e) Finding the value of the angle.

In P. Y. Galperin's theory, the assimilation of knowledge is considered as a process carried out based on assimilation of actions to apply the acquired knowledge. The formation of new thought processes begins with the development of the instructions developed by the teacher, presented in the form of detailed external actions. The detail of the action to solve the problem of elementary actions or operations makes the process of learning new methods of solving problems meaningful, conscious, as it reveals the objective logic of the solution process. Inclusion in the process of solving a geometric problem by an analytical method of actions on geometric illustration of the condition and interpretation of the obtained analytical result provides the basis for new ideas of thinking activity contributing to the formation of the research structure of thinking. At the same time, during the transition of actions, the mental plan, the student's activity to create a geometric image of an adequate analytical model includes activities in collapsed forms of reasoning. The geometric image becomes a "support signal" and a necessary link in the activity to solve the problem by an analytical method. The use of the modeling method in the development of teaching methods for solving geometry problems is presented for several reasons. First of all, these methods themselves are a means of mathematical modeling by which students receive a sign model adequate to the condition of problems: the transformation of this model according to the relevant laws and its analysis allow you to fulfill the requirement of the problem and move from a formal model to its geometric interpretation. The activities that students perform include all the stages of which mathematical modeling consists. At the same time, the requirement of the task is fulfilled and the skills of mathematical modeling are formed, i.e. the goals of the activity of mastering a new method of solving the problem and a new way of reasoning are realized. Let's consider a system of tasks that contribute to the formation of the ability to draw conclusions, to obtain a variety of consequences from their conditions. The significance of the developed system is that it allows students to identify not only the level of assimilation of theoretical material on the topic "Vector method", but also, most importantly, contributes to teaching students the techniques of recognition of geometric images at the first stage.

The use of the vector method in specific situations causes certain mental activity. To determine the content of tasks that form the ability to apply vectors, it is necessary to identify actions adequate to this activity. The analysis shows that the use of the vector method in situations a) – e) involves the possession of the following skills:

1) translate geometric language into vector and vice versa;

2) perform operations on vectors; 3) represent a vector as a sum of vectors, the difference of vectors; 4) represent a vector as a product of a vector by a number; 5) transform vector equalities; 6) move from the ratio between vectors to the ratio between their lengths and vice versa; 7) express the length of a vector through its scalar square; 8) express the magnitude of the angle between vectors in terms of their scalar product. Due to the possibility of using a common logical scheme for finding a solution to a problem, analytical methods allow us to develop prescriptions for solving classes of problems that are models of activity samples in which the ways of finding a solution and implementing the requirements of a geometric problem by analytical means are verbally described.

The main idea of the activity approach in the interpretation of G.I. Sarantsev is the expediency of describing and designing the activities of students as a system of problem solving processes. We consider this approaches to teaching the analytical method of solving planimetric problems by developing and applying a methodologically expedient system of problems. Learning through problems in this case is the only way in which students can master new methods of solving, assess their advantages, learn the specifics of applying numerical methods to the study of the properties of geometric objects. The success of the vector method in various situations is largely due to the possession of a special dictionary used to translate from geometric language into vector language and back. This dictionary can be represented by the following table (table 1).

Table 1 – Dictionary used to translate from geometric language into vector language and back.

Language of geometry	Vector language
$AB \parallel CD$	$\overrightarrow{AB} = R \cdot \overrightarrow{CD}$ $R \neq 0$
$AB \perp CD$	$\overrightarrow{AB} \cdot \overrightarrow{CD} = 0$
The C point belongs to the straight-line AB	$\overline{AB} = R \times \overrightarrow{BC}$, or $\overline{AC} = R \times \overrightarrow{BC}$ or $\overline{AC} = R \times \overline{AB}$ or $\overline{OC} = p \cdot \overline{OA} + q \cdot \overline{OB}$ O – arbitrary point, $p + q = 1$
M – the middle of the segment AB	$\overline{AB} + \overline{BM} = 0$ $\overline{OM} = \frac{1}{2}(\overline{OA} + \overline{OB})$, O-arbitrary point
M_1 – the middle of the segment A_1B_1, M_2 – the middle of the segment A_2B_2	$\overrightarrow{M_1M_2} = \frac{1}{2}(\overline{A_1A_2} + \overline{B_1B_2})$
M – centroid ΔABC	$\overrightarrow{OM} = \frac{1}{3}(\overline{OA} + \overrightarrow{OB} + \overrightarrow{OC})$ O-arbitrary point Or $\overline{MA} + \overline{MB} + \overline{MC} = 0$
Point C divides segment AB in $AC : CB = m : n$	$\overline{AC} = \frac{m}{n}\overline{CB}$ or $\overline{OC} = \frac{m}{m+n}\overline{OA} + \frac{m}{m+n}\overline{OB}$ here O – arbitrary point
$O_1A_1B_1C$ – points of one plane	$x \cdot \overline{OA} + y \cdot \overrightarrow{OB} + z \cdot \overrightarrow{OC} = 0$ here x_1, y_1, z_1 – real numbers, also $x + y + z = 1$
$ABCD$ – parallelogram	$\overline{AC} = \overline{AB} + \overline{AD}$ $\overline{AB} = \overline{DC}$ $\overline{BC} = \overline{AD}$ $\overline{MO} = \frac{1}{4}(\overline{MA} + \overline{MB} + \overline{MC} + \overline{MD})$ Here M-arbitrary point, a O – the point of intersection of diagonals parallelogram $ABCD$
$AB \perp \alpha$, CD *u* MK – intersecting straight planes α	$\overrightarrow{AB} \cdot \overrightarrow{CD} = 0$ and $\overrightarrow{AB} \cdot \overrightarrow{MK} = 0$

This dictionary also includes a few reference problems that are the key to solving many more complex problems using vectors. These include the conditions that determine the belonging of a point to a straight line, the division of a segment in this respect, the belonging of four points of the plane.

The analysis of the activity of using vectors in various specific situations made it possible to identify actions in its structure that determine the type of tasks corresponding to it, namely tasks:

– to translate from geometric to vector language and vice versa;
– to perform vector operations.
– to represent a vector as a sum (difference) of vectors;
– to represent a vector as a product of a vector by a number;
– on the transition from the ratio between vectors to the ratio between lengths and vice versa;
– on transformations of vector equalities.
– to find the length of the vector and the magnitude of the angle between them All types of problems include the basic properties of vectors, most problems - involves the possession of

the ability to represent vectors in the form of a sum (difference), to translate the geometric language into a vector and vice versa, the possession of some actions with vectors at the mental stage. The experiment showed the feasibility of the following combinations of levels of formation of skills to perform operations on vectors and represent the vector in the form of the sum (difference) of vectors, the product of a vector by a number: 1) the formation of mutually inverse skills is carried out at a materialized level; 2) the solution of problems for the representation of a vector in the form of a combination of other vectors is carried out mentally, and the verification of the correctness of the execution of this action is carried out at the material level; 3) the formation of mutually inverse skills is carried out only in the mental plane.

Thus, the solution of mathematical problems by the vector method contributes to teaching students not only to find the optimal vector solution to the problem, but also to form in their minds the techniques and ways of knowing geometric images.

Список использованных источников

1. Папышев, А. А. Теоретико-методологические основы обучения учащихся решению математических задач в контексте деятельностного подхода: монография. – Саранск : Референт, – 2007. – 327 с.

2. Papyshev A. A. Theoretical and methodological foundations of training students solving mathematical problems in the context activity approach: Monograph. – Saransk: Referent, 2007. – 327 p.

УДК 372.851

О. Н. Пирютко, А. С. Ющенко

O. Pirutko, A. Yushchenko

УО «Белорусский государственный педагогический университет имени Максима Танка» (Минск, Беларусь)

ЧИТАТЕЛЬСКАЯ ГРАМОТНОСТЬ КАК ПРИОРИТЕТНЫЙ КОМПОНЕНТ ФУНКЦИОНАЛЬНОЙ ГРАМОТНОСТИ ПРИ ОБУЧЕНИИ МАТЕМАТИКЕ

READING LITERACY AS A PRIORITY COMPONENT OF FUNCTIONAL LITERACY IN MATHEMATICS TEACHING

В статье рассматривается читательская грамотность в качестве приоритетного компонента функциональной грамотности при обучении математике в УОСО, определяются направления формирования читательской грамотности при обучении математике.

The article considers reading literacy as a priority component of functional literacy in teaching mathematics in institutions of general secondary education, determines the directions of formation of reading literacy in teaching mathematics.

Ключевые слова: читательская грамотность; функциональная грамотность.

Keywords: reading literacy; functional literacy.

Одной из основных задач, поставленных в концепции развития образования Республики Беларусь до 2030 года, является формирование функциональной грамотности учащихся [1].