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ENSURING INTERDISCIPLINARY CONNECTIONS IS A FACTOR IN STRENGTHENING THE PRACTICAL DIRECTION OF MATHEMATICS

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ABSTRACT: This article substantiates the possibilities of strengthening the practical orientation in the process of teaching mathematics based on the principle of "Interdisciplinary Connection" in didactics. The role of such problem questions is revealed through problem questions of practical content. At the same time, the work formulates requirements for compiling problems of practical content.

Key words: Interdisciplinary principle, practical content problem, equation, system of equations, diagram, percentage, trigonometry, function.

INTRODUCTION

The practical direction of mathematics teaching in traditional education was reflected in one of the didactic principles—the polytechnic principle. Subsequently, with the development of human activity and the emergence of new modern sciences, as well as the mathematization of these disciplines, the strengthening of the practical orientation of mathematics teaching has become one of the primary factors in solving problems not only in the production sphere characteristic of the polytechnic principle but also in fields such as economics, ecology, sociology, history, jurisprudence, and biomatematics. The main means of strengthening the practical orientation of mathematics teaching is tasks of practical content.

RESEARCH METHODS

The main feature of the school algebra course is that concepts such as numbers, transformations, equations and inequalities, and functions are more or less theoretically substantiated in its content.

RESULTS AND DISCUSSIONS

The main goals of teaching mathematics in modern schools are as follows, whereby every pupil [1]:

to consciously acquire sufficient mathematical knowledge necessary for studying other disciplines and continuing education;

formation of thinking abilities characteristic of mathematical activity and necessary for effective functioning in society;

Currently, in improving mathematics education, it is important to strengthen the practical orientation of the school mathematics course, in other words to link its content and teaching methodology with practice.

The Russian methodologist N.A. Tereshin considers the concept of “practical content problem” as “a problem set outside of mathematics and solved using mathematical means”.

G. M. Morozov, approaching the formation of the definition of the concept of “practical-content problem” from the perspective of “activity”, asserts that “as the primary concept of the formative property in defining a practical-content problem, the property associated with teaching pupils the activity of applying mathematics to solve various problems is highlighted”.

Strengthening the practical focus of the school mathematics curriculum requires special training for the teacher, who is one of the key participants in the educational process. Specifically, this includes [3]:

solving practical tasks requires more time than studying theoretical material. Therefore, every mathematics teacher must possess the skills and abilities to correctly plan and design lessons, as well as to rationally allocate time;

must possess the skills and abilities to select or independently compose tasks of practical content..

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When choosing or drafting practical content tasks, it is important for the teacher to adhere to the following requirements for them [3]:

1. The content of practical-oriented tasks must include both mathematical and non-mathematical tasks. At the same time, the relationship between mathematical and non-mathematical problems must be reflected in their content.
2. The content of each selected or compiled practical task must correspond to the topic or program being studied, and its solution must contribute to the achievement of educational goals.
3. Concepts and various terms in the content of a practical task must be understandable to the pupil.
4. Concepts and various terms in the content of a practical task must be understandable to the pupil.
5. The content of a practical task must correspond to reality.

For this, every mathematics teacher must [3,4]:

a) identifying mathematical topics that exert a broad influence on the formation and development of an individual's worldview.;

b) identifying the most suitable topics for using the mathematical apparatus in teaching subjects such as physics, biology, chemistry, drafting, technology, political science, linguistics and jurisprudence.;

c) correct determination of the purpose of the studied topics and, on this basis, the correct selection of teaching methods and techniques.;

d) possessing the skills and abilities to design each lesson based on preliminary planning;

These analyses show that most of the problems presented in school mathematics textbooks do not fully meet the requirements for practical content problems. Therefore, for each lesson, the teacher must select practical-content problems from other sources in advance or compose them independently..

We consider it appropriate to implement the solution of practical problem in the following stapes. [1,2,4]:

1. Analyzing a problem text.
2. Establishing relationships between an information of the problem and its questions.
3. Translating the problems text into mathematical language specifically, constructing a mathematical model.
4. Solving the mathematical model.
5. Checking and evaluating the solution of the problem.

Below, we present issues related to interdisciplinary relations.

Problem 1 (Economics). A person took out 1/4 of all their money from a savings bank, then 4/9 of the remaining money, and another 64 dollars. After that, 3/20 of all his money remained in his savings. What was the initial amount of savings?

Solution. Let there be a sum in the savings bank x \$.

When first withdrawn, $\frac{x}{4}$ \$ is taken, remaining \$.

On the second withdrawn, \$ is taken.

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Well, $\frac{x}{4}+\frac{3x}{4}\cdot\frac{4}{9}+64+\frac{3x}{20}=x \Leftrightarrow \frac{x}{4}+\frac{3x}{9}+64+\frac{3x}{20}=x \Leftrightarrow x-\frac{x}{4}-\frac{3x}{9}-\frac{3x}{20}=64 \Leftrightarrow$ $16x=64\cdot 60 \Leftrightarrow x=240$ $.

Answer: 240$.

This means that the client's initial deposit was $240 USD.

Problem 2 (Chemistry). Add 7 liters of water to 5 liters of a 16% aqueous solution of the substance. What will be the percentage concentration of the resulting solution?

Solution. Solution concentration $\rho=\frac{V_1}{V_2}\cdot 100\%$. The volume of the substance in the initial solution is $0{,}16\cdot 5=0{,}8$. When 7 liters of water are added, the total volume of the solution becomes equal to 12 liters. The volume of the dissolved substance remains the same.

Thus, the concentration of the resulting solution is $\frac{0{,}8}{12}\cdot 100\%=6{,}7\%$

When 7 liters of water are added to 5 liters of a 16% solution, 12 liters of a 6.6% solution are formed.

Note. The concentration of a solution is equal to the ratio of the mass of the solute to the mass of the solution, as well as the ratio of their volumes.

Answer: 6,7%

Problem 4 (Technical Sciences). A bathyscaphe steadily submerged in water vertically emits ultrasonic pulses with a frequency of 362 kHz. The batiskaf's submersion speed into the water is calculated using the formula. Here $c=1300\,m/s$ - speed of sound in water, f_0 - frequency of emitted pulses, f - sound frequency (kHz measurement unit). Determine the sound frequency in kHz if the immersion speed of the bathyscaphe is 4 m/s.

Solution. $v=4\frac{m}{s}$, $c=1300\frac{m}{s}$, $f_0=362\text{kHz}$

$v=c\frac{f-f_0}{f+f_0}=1300\cdot\frac{f-374}{f+374}=4$;

$1300(f-362)=4(f+362)$, $325(f-362)=(f+362)$,

$325f-325\cdot 362=f+362$

$324f=362+325\cdot 362$, $324f=118012$, $f=364$

A

bathyscaphe is a self-propelled underwater craft designed for deep-sea oceanographic and scientific research.

Answer:364

A bathyscaphe submerged in water at a speed of 4 m/s has a sound frequency of 364 kHz.

Problem 5 (From physical education). The volleyball ball was thrown at an angle α. The ball's flight time is determined by the formula $t=\frac{2v_0\sin\alpha}{g}$. Under what angle should the

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ball be thrown if it was thrown with an initial velocity $v_0 = 50 m/s$ and its flight time is 5 seconds? The acceleration of free fall is $g = 10 m$.

Solution.

$t = \frac{2v_0 \sin\alpha}{g}$; $v_0 = 50 m/s$; $g = 10 m/s$; $t = 5s$;

$5 = \frac{2 \cdot 50 \cdot \sin\alpha}{10}$

; $\sin\alpha = \frac{1}{2}$; $\alpha = 30^\circ$.

Answer: 30°

This means that the volleyball ball thrown at an angle of 30° with an initial velocity of $50 m/s$ can fly for 5 seconds.

Conclusions:

Overall, strengthening the practical orientation of mathematics teaching plays an important role in ensuring:

- ensuring the intellectual development of pupils;
- active participation of pupils in the educational process;
- increasing interest in studying mathematics.

CONCLUSION

The extensive use of practical tasks that serve to ensure interdisciplinary connectivity in mathematics teaching plays an important role in strengthening the practical orientation of mathematics.

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