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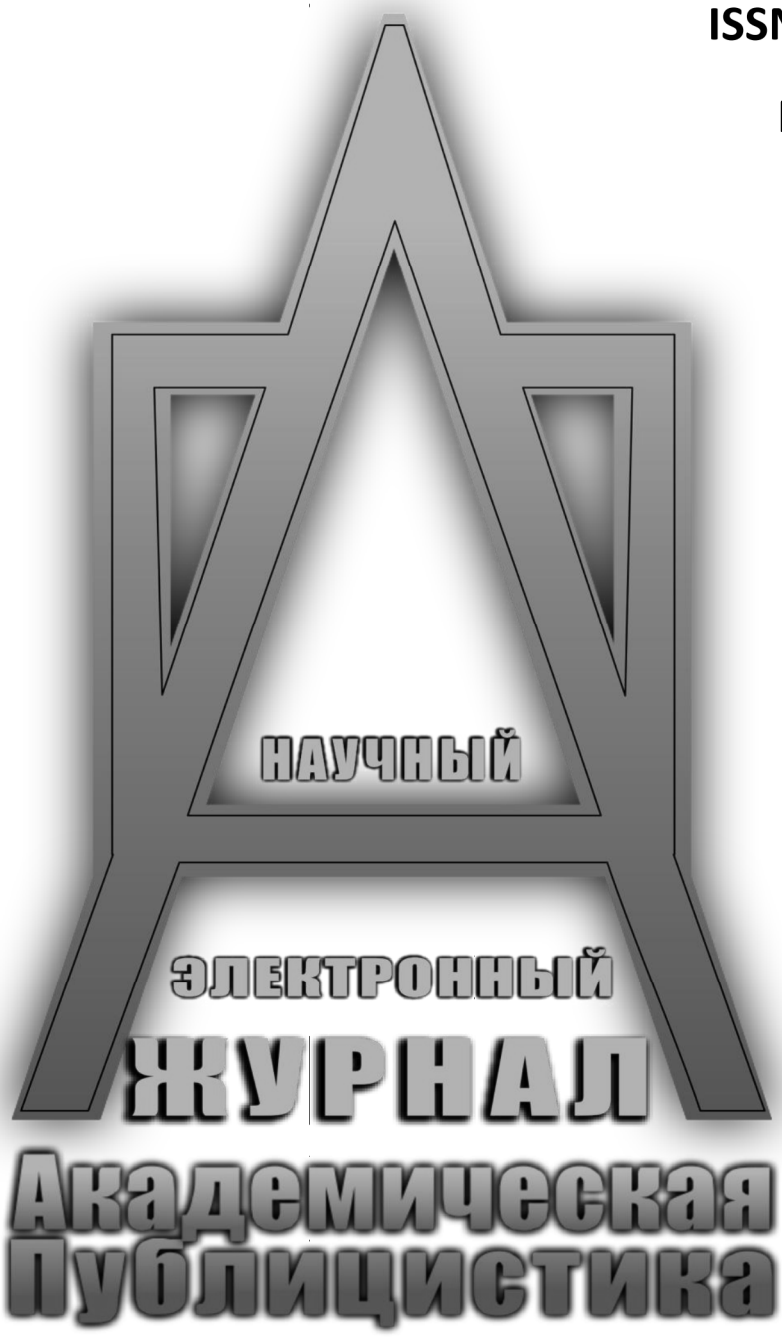

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METHODS TO DESIGN AND USE GEOMETRIC PROBLEMS SOCIATED WITH REALITIES IN TEACHING GEOMETRY AT HIGH SCHOOL

Abstract

This article will do some research on some methods of designing geometry problems associated with practice in teaching Geometry in high school. The process of formation and development of Geometry is always connected with practice. Therefore, teaching Geometry needs to be associated with the history of formation and development of Geometry. Learning associated with practice concerns the unifying principle between theory and practice - one of the most fundamental principles of education. [3, p. 3-7]. The design of Geometry problems associated with practice in teaching is principal to meet the needs of teaching mathematics trend in the new age.

Keywords:

Reality, practice, thinking, model.

Đặt vấn đề

The position of Mathematics in the general education curriculum has been placed in a specially important position by most countries in the world. Mathematics in high school is an independent subject, from primary school to high school, it is a fundamental and core subject in order to equip students with basic and modern high school math

knowledge, practice calculation skills and develop mathematical thinking. Contributing to problem solving and general intellectual abilities, especially the ability to analyze, synthesize, abstract, and generalize. "Mathematical knowledge skills and methods are the basis for acquiring knowledge of science and technology, contributing to the learning of other subjects in high school and applying them to life" [2] . Math teaching will be more effective if teachers make students see the meaning of the Math content that they are learning. Through teaching, it is necessary to show the meaning and application of knowledge so that students can see how Mathematics originates from reality and serves reality?

We are oriented to the study and proposal of methods to design and use geometric problems associated with realities in teaching geometry at the high school as follows:

Orientation 1: The problem of giving content to serve general education, in accordance with the requirements of fundamental innovation Vietnam comprehensive education in the current period [1]: The contents of general education told ensure streamlining, modern, practical, practice, apply knowledge into practice [2].

Orientation 2: Measures to help develop educational programs: "Adjustments and supplements, updates, refresh all or some elements of education, ensures the development and stability relative of education had, in order to make the implementation of targeted programs of education set out to achieve the best efficiency, consistent with the characteristics and needs of social development and the development of fish student workers"[3].

Orientation 3: Each measures to orient high school mathematics teachers can design some of the problems to be used in the teaching process. Specifically as follows: There are ways to design problems geometry students help explore, discover and explore the knowledge of lessons, support for student access concept, theorem (measure 1); There are ways to design problems geometry students help find the meaning, the practical value of knowledge geometry (measures 2, measure 3); There are ways to design problems students help deepen and expand knowledge (measures 3, measure 4);

There are methods to design the problem to assess the capacity of understanding mathematics, into practical use of students (measure 4); There are ways to design problems helps students practice geometry, consolidate knowledge and skills through calculating the quantity geometry (measure 5).Requirements: Each measure must be stated clearly: The purpose of the measure; Pursuant to the measures; How to implement the measures and the use of problems in teaching designed geometry at high schools.

Orientation 4: The problem must be designed to fit the qualifications, capabilities and knowledge.

With difficult problems, need grading operations, motivations (beginning, intermediate, end) to help students overcome the difficulties and obstacles in the process of problem solving.

2.1. Method 1. Design the problem of geometric knowledge discovery based on teaching facilities made from simple materials in practice

2.1.1. Purpose of the method: This method help teachers design the problem or situation to explore the knowledge or study of geometry based on the teaching facilities made from simple materials available in practice.

2.1.2. Basement of the method: Based on the laws of cognitive activities; Based on the concept "What is effective teaching?"; Based on the meaning and effect of the teaching facilities; Based on the meaning and effect of the discovery teaching methods in mathematics.

2.1.3. Implementing methods and using the designed problem

We propose the implementation process of this method as follows:

Step 1 (prepare): Base on the content of the lesson, teachers design the detection problem to discovery geometry knowledge for students (through questions, activities, learning patterns ...) and design means made from simple materials in fact to support students to solve problems, prepare the answers and operating results.

Step 2 (implementation): Teachers organize and manage the classroom; students discover knowledge and record operating results.

Step 3 (discussion of the whole class): Teachers organize that students exchange and discuss results of solving with the whole class.

Example 2.1.1. Design problems learn about the conic (Geometry 10)

Could use a funnel cone glass or hard plastic molds used for making hats with modeling clay blocks (usually used as toys for children), then use a knife to cut blocks of this land, have shaped profiles different conic.

Example 2.1.2. Design problem about revolution Hypeboloit (Geometry 12)

Picture – 1

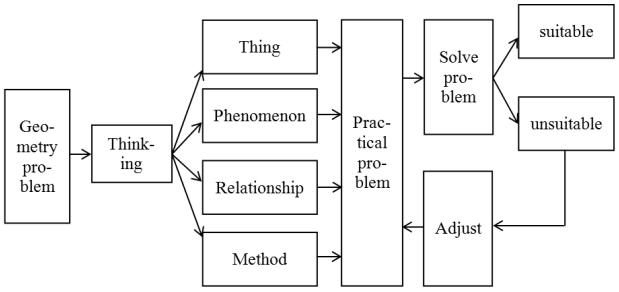
2.2. Method 2. Relating pure geometry problem to a practical situation to design problem associated with reality

2.2.1. Purpose of the method: The method aims to create practical problems associated with the problem of pure geometry through thinking.

2.2.2. Basement of the method: Based on the role of thinking; Based on the role of pedagogic metabolization; Based on the results.

2.2.3. Implementing methods and using the designed problem

We propose the implementation process of this method as follows:



Picture – 2

In this process: Starting from a problem (pure mathematics) we can relate to an object, or a phenomenon, a relationship in fact, a solution that can transform from the pure mathematic problem into practical ones. For example, a square can relate to a square-shaped objects, such as floor tiles; an ellipse may relate to the orbit of a planet in the solar system; two crossed lines may relate to a highway and a high street; from the calculation of a triangle edge, knowing the other two sides and the angle opposite to it, we can think to calculate the distance between two points that are not directly measurable.

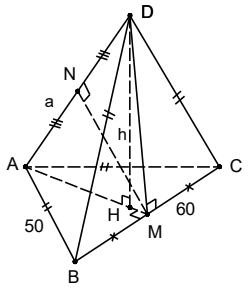
Example 2.2.1. Design problems of the vision of a meteorological satellite, related to the problem of sphere tangent (Geometry 12)

Geostationary meteorological satellites circling the earth above the equator at an altitude of about 35,880 km (22,300 miles). Calculating the area of the bridge can be seen from satellites, said that the demand side is a pompoms an area calculated by the formula $S = 2\pi rh$ r is the radius of the Earth ($r \approx 6371$ km) and h is height pompoms.

Example 2.2.2. Design problem of ballooning, related from the problem of the pyramid (Geometry 12): A big balloon D attached recording device observing a fairground, which is tied with rope to three points A, B, C on the ground, AB = AC = 50 m, BC = 60 m. Assuming that the wires are stretched, the string length is: BD = DC = 50 m, AD = a (m)

a) When a = 60 m, find the distance from balloon D to the ground.

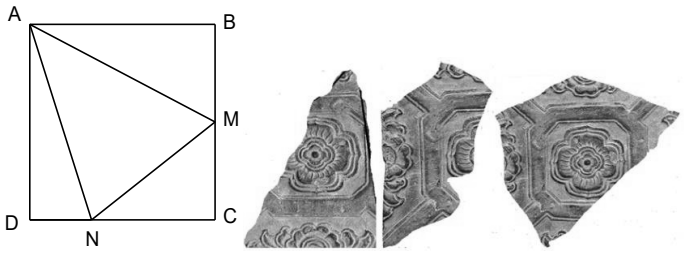
b) How much should the length a be, so that the balloon is 20 meters above the ground?



Picture – 3

Example 2.2.3. Design problem of determining the size bricks flowers, reminiscent of the problem of determining the square (Geometry 10): Since the problem of determining a central square to hear a point M of a side of the square, a point N over a third of the adjacent edge and said a line through points N may pass through a square top, we can set out a practical situation as follows.

In an archaeological phase, people discovered the bricks crumble flowers. The archaeologists predict that these are the debris of bricks decorated flower, square shape, with each other; each side of the square are the borders that align with different colors and each corner has a small decorative flowers. In the piece of rubble, there is also a piece of the border, there are still a few pieces on each border point. Is it possible to determine the magnitude of the bricks that (length side of the square), from the debris looking for in the following cases, or not?



Picture – 4

a) Knowing two points on one side of the square and a point on the opposite edge.

b) Knowing two points on one side of the square and an adjacent point on the other side.

c) Knowing three points on three different sides of the square.

d) Know the four points on four different sides of the square.

2.3. Method 3. Selection of practical problems which can be explained by common mathematical knowledge or solve by means of a mathematical model for designing problem system

2.3.1. Purpose of the method: Design a problem or problem system to explain an issue in practice and help students see the meaning of the common knowledge and can

use mathematical models to solve a problem.

2.3.2. Basement of the method: Based on the goal of teaching mathematics; Based on the meaning and process of mathematical model; Based on the purpose of similar activities.

2.3.3. Implementing methods and using the designed problem

Teachers first choice practical situations which have been introduced in textbooks, in the references and figure out how to explain to the practical situations. Then they have to design problems or system of problems in the learning patterns, help students gradually explain practical situations. Or they can organize discussions, cooperative learning, large assignments, seminars and projects in practical situations to deepen and expand the knowledge of geometry in high school.

Example 2.3.1. Design problems of the cylinder volume fraction of revolution is cut by a plane oblique to the axis (the angle between the straight lines and sharp corners plane) and the surrounding area of that section (Geometry 12).

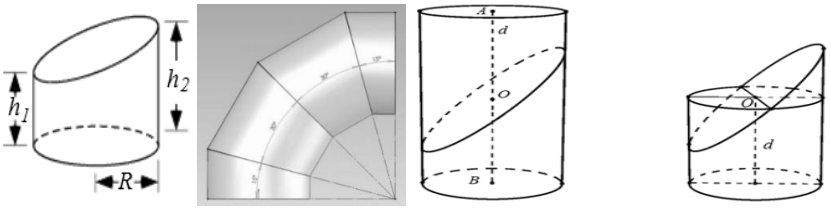
Practical situations are set as follows: In an industrial park it is arranged a gas pipeline system serving the air conditioner. Placed along the walls are flat circular cylindrical tube connecting the corners xoay. At transplant some people are cut beveled cylinder. The question is how to calculate the volume and surface pulse quanhcua air duct system should look like?

The mathematical problem is following:

For a cylinder of revolution (T) and a plane surface (P) cut all the way to its birth. Calculate the volume of the cylinder section located between a bottom surface of the cylinder and that intersection and the area of development of the form; Knowing that the radius of its base by R and the distance between the center and bottom center of the cross section (T) to cut by (P) by d. (Figure 33)

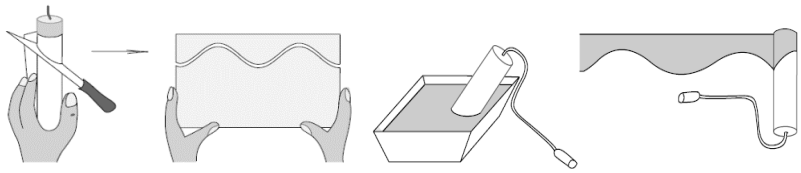
To help students solve the problem on, we can set up the system suggest the following questions: (1) When the plane (P) parallel to the bottom of the image forming cylindrical shape is what? The volume of the building blocks of how calculated? (2) When

the plane (P) cut oblique to the axis of the cylinder, can change shape to form the first case or not? How change?



Picture – 5

Example 2.3.2. Design developed the problem of road intersection of a cylindrical surface and a flat surface with the axis of the cylinder creates a sharp corner (Geometry 12): Practical situations are set as follows: Wrap a piece of paper around a cylindrical candle and cut it obliquely by a knife, we get an elliptical cross section and a wavy curve if cover up that piece of paper on a plane. What is that curve?



Picture – 6

2.4. Method 4: Exploit the potential Geometric knowledge in real shapes, blocks and modern architecture to design Math questions or Math question system on Geometric comprehension.

Steps of the implement the are as follows:

+ *Step 1:* The teacher must discover the geometry knowledge hidden in the modern architecture. For this it is neccessary to ask questions, issues of observing the structure as follows:

- Structures close to which spatial shape learnt in geometry in high school?

- Which straight lines, planes, surfaces are hidden in the architecture?

- Which problem of quantity (distance, angle magnitude, area, volume) can be set

off from the architecture?

- How connections, parallel relationship, perpendicular relationship ... can be exploited in the architecture?

+ *Step 2:* Teachers should set up a suitable system of questions, problems, arranged in a logical order so that the resolution of the previous problem may suggest to solve the problem later, support students solve problems.

+ *Step 3:* Teachers organize students to discuss, cooperate to learn, or do the assignments, organize seminars, project execution .... Then, students will see the meaning of the content of math learned in high school, feel that lessons could really be interesting and attractive.

Example 2.4.1. Design a problem by observing the modern architecture (Geometry 12)

Picture – 7

Questions

(1) What is general shape of the structures in the above picture? (2) Is it possible to use straight steel rods, straight concrete columns to form the frame structure of the building or not?

To get the answers, let's study the system of problems related to these structures, which is set out as follows:

Problem 1. Given a cylinder has a rotating shaft $O_1O_2 = l$, the bottom circle is (O_1, R) and (O_2, R) (Figure 42, 43, 44). The segment AB has a constant length k, moves on two circles: A moves on the circle (O_1, R) and B moves on the circle (O_2, R). Prove that each point M of the segment AB moves on a fixed circle.

Problem 2. Given a cylinder has a rotating shaft $O_1O_2 = l$, the bottom circle is (O_1, R)

and *(O_2, R)* (Figure 45). The segment *AB* has a constant length *k*, moves on two circles: *A* moves on the circle *(O_1, R)* and *B* moves on the circle *(O_2, R)*. Call *O* is the midpoint of O_1O_2, *E* is the midpoint of *AB* and *D* is the midpoint of *BC*. *A* fixed point *M* on section *AB*, *F* is the projection of *M* on *ED.* Find relation between length of *MF* and *OF* with *R, l, k*.

Problem 3. Prove that the (H) by AB during rotation around the axis (O_1O_2) is the hypeboloit.

2.5. Method 5. Based on figures, blocks or situations in practice, introduce appropriate elements to design the problem to calculate the quantities of length, area, angle and volume of figures, blocks learnt in geometry program at high school

Conclusion

Today most countries in the world have focused on capacity development objectives for learners, especially thinking capacity, the capacity to solve the problem. Therefore, in teaching mathematics in general, geometry particular, need to enhance their ability to apply their mathematical knowledge and skills into practice through solving situations that arise in life: the capacity to model practical situations assumptions or real-life situations. Teachers need to help students develop the skills that they will use everyday to solve problems, and should help students feel that math is useful and meaningful, to help them believe that they can understand and apply math. However, practice shows that many teachers of mathematics has not paid adequate attention to those tasks, mainly interested in the concept, the pure mathematical clause and the only theoretical problem, make the math becomes boring, not attract students.

Research from works published abroad, we saw a number of countries already have programs, projects, exams connection math with life, such as Programme for International Student Assessment (PISA) and High School Mathematical Contest in Modeling (HiMCM) in the past two decades. In our country, some studies have put into these events, in fact phenomena related to common mathematical knowledge; or interest in the use of means in practical support for teaching geometry, help students explore some of spatial geometrical knowledge.

To contribute to developing the school program, serving educational objectives, we study and propose measures designed geometrical problems associated with practical use in teaching geometry in high school. We hope that our measures may help high school teacher to design geometrical problems associated with practices, contribute to the content of school education, in accordance with the requirements of fundamental innovation throughout Vietnam comprehensive education in the current period.

We propose five measures designed goemetrical problems associated with the practice and use them in teaching geometry at high schools. Pedagogical experimental results at 6 high schools from many different regions somewhat have demonstrated the feasibility and effectiveness of the proposed methods.

Recommendation

Design geometrical problems associated with the practical in teaching geometry at high schools is very difficult and shortcoming, so that it is necessary to encourage, guide and implement further methods to design and use problems associated with the practice.

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