CURRENT RESEARCH JOURNAL OF PEDAGOGICS (ISSN: 2767-3278)

VOLUME: Vol.07 Issue05 2026
DOI: - 10.37547/pedagogics-crjp-07-05-11
Page: -49-54
RESEARCH ARTICLE OPEN ACCESS

Importance of Creative Thinking Component in Developing Research Ability in Physics Education

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Received: 13 April 2026 **Accepted:** 05 May 2026 **Published:** 31 May 2026

ABSTRACT

This article highlights the issues of developing students' research abilities, in which the component of creative thinking was selected as a factor that enhances research potential. An analysis of problems corresponding to this component is presented.

Keywords: Analytical ability, innovative thinking, talent, creative potential, creative skill, interest.

INTRODUCTION

The current rapid development of science and technology is creating certain problems in physics education and is giving impetus to the development of new technologies. In the process of teaching school students, it is becoming increasingly difficult to cover the achievements of modern science and technology. Since the volume of scientific information is continuously increasing, the possibility of regularly introducing a large amount of new knowledge in physics is limited. In addition, in teaching physics at school, it is of great importance to make wide use of modern research methods, in particular, computer modeling based on digital methods.

This problem is relevant in teaching gifted school students in physics. In identifying giftedness, we understand students who show interest in physics and achieve high results, and we compare their indicators with those of their peers. Later, such students may study in universities and scientific institutes in the fields of physics and technology.

Gifted school students in the field of physics show interest in issues related to scientific and technological progress. Therefore, the insufficiency of information about the achievements of science and technology may limit their ability to consciously choose the direction of their future professional activity.

In psychological and pedagogical literature, such terms as “research abilities”, “readiness for research”, “research work”, and “giftedness” are widely used. However, these terms differ from one another in terms of content. As many authors [1–5], in particular S.B. Rijikov [6], emphasize in their studies, this situation is largely related to differences in the scientific goals set by different groups of researchers and in the experimental results obtained. This information applies to frequently used terms such as intellect, personality, talent and others. Therefore, it is necessary to begin this work by clarifying and delimiting the meanings of the terms: curiosity, exploratory activity, search behavior, research activity, discovery abilities, discovery lessons, research work, children's giftedness, gifted children and other related concepts.

The aim of the research is to substantiate, develop and implement in practice a methodological system for developing the research abilities of gifted school students in physics education.

Using modern methods of professional research in the field of physics, it is appropriate to involve middle and senior school students in advanced-level research in physics and to use effective components in developing research abilities.

In the process of developing students' research abilities in physics education, the component of creative thinking is of great importance.

Creative thinking [7] is a type of thinking aimed at creating solutions that did not previously exist for new or existing problems, and it is sometimes associated with free associative processes that arise in the brain. It is also closely related to the concept of creativity, which can be stimulated through systematic thinking. One of the most important components of creative thinking is critical thinking. As the name suggests, this type of thinking refers to a mode of thinking capable of creating, inventing or producing something new. This type of thinking allows new ideas to emerge, as well as different views to be formed regarding certain aspects. Therefore, studying the importance and role of developing students' creativity, increasing their learning activity on the basis of independent thinking, and developing their existing talents remains a relevant issue.

Based on these facts, among the problems of the mechanics section, tasks that specifically develop creative thinking ability are selected, and an analysis of solving examples based on them is presented [8–9].

Problem 1: A projectile flying with velocity ϑ explodes and splits into two fragments whose mass ratio is 1:4. The first fragment, which has the smaller mass, moves at a speed of 50 m/s at an angle of 30° to the initial direction of motion. If the speed of the second fragment, which has the greater mass, is 6.25 m/s, find the angle between the directions of motion of the fragments.

Solution: Let us relate the masses of the projectile fragments to the initial mass m (Figure 1):

$x + 4x = m$ from this $x = \frac{m}{5}$

Therefore, the mass of the small fragment is: $-m_1 = \frac{m}{5}$

The mass of the large fragment is: $-m_4 = \frac{4m}{5}$

Let us draw the following diagram according to the condition of the problem:

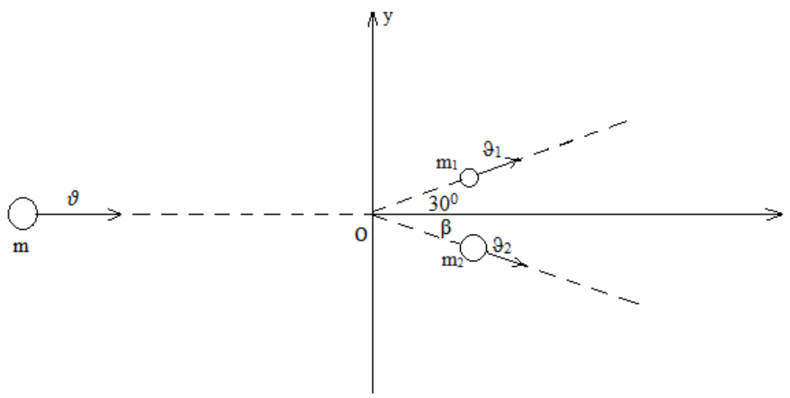

Figure 1.

By taking the projections of the sums of the momenta of the projectile before and after the explosion onto the Y-axis, and based on the law of conservation of momentum, we write the following:

$0 = \frac{m}{5} \cdot 50 \cdot \sin 30^0 - \frac{4m}{5} \cdot 6{,}25 \sin\beta$ from

$5 = 5\sin\beta$ from $\sin\beta = 1$ from: $\beta = 90^0$

Oh, so the second fragment moves at an angle of 90° relative to the initial direction, doesn't it? Yes, we did not know that before either. If we draw the diagram like this, it will be more correct (Figure 2):

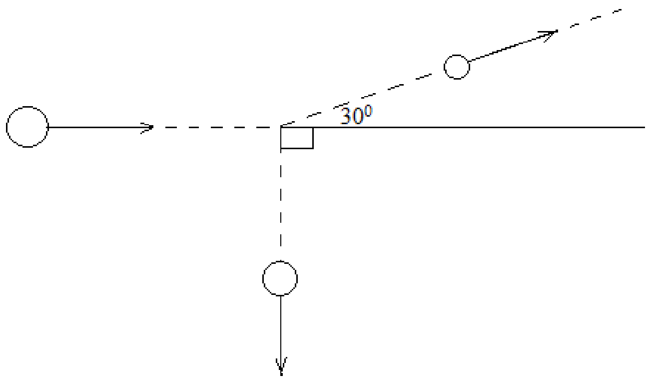

Figure 2.

Therefore, the angle between the directions of motion of the fragments is equal to $x = 90^0 + 30^0 = 120^0$.

Problem 2: How much work must be done to lift a uniform rod, 8 m long, to a height of 3 m from a point located 2 m away from one of its ends? The mass of the rod is 200 kg.

Solution: The work done is equal to the change in the potential energy of the center of mass of the rod. First, we determine the final height of the center of mass of the rod (Figure 3):

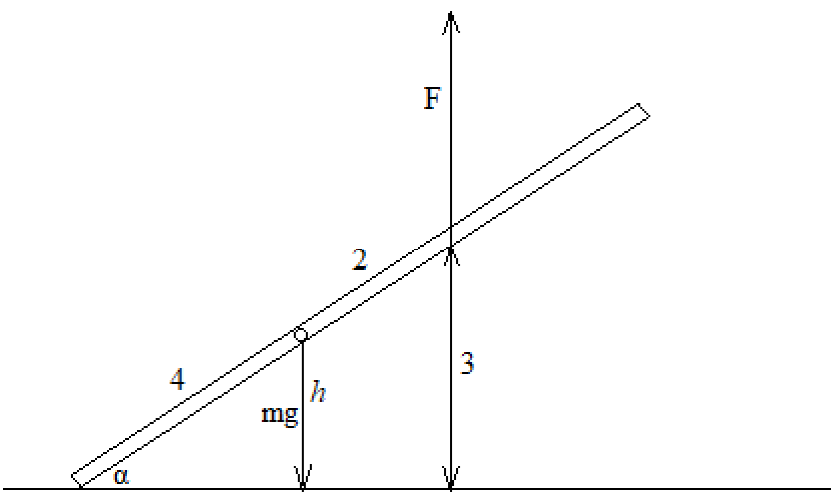

Figure 3.

From the similarity of triangles: $\frac{h}{4} = \frac{3}{6}$ hence $h = 2m$

In that case: $A = mgh = 200 \cdot 10 \cdot 2 = 4000\,j$

Problem 3: Half of a cube, that is, a prism with an edge length of (a=40) cm, is placed on the inclined surface of a vessel filled with water as shown in the figure, and water does not enter under it. If the upper surface of the prism is 20 cm below the water level, and the coefficient of friction between the prism and the inclined surface of the vessel is equal to 0.2, what should be the density of the material from which the prism is made in order for the prism to be in equilibrium? (kg/m^3) (Figure 4)? ($P_0=10^5$ Pa)

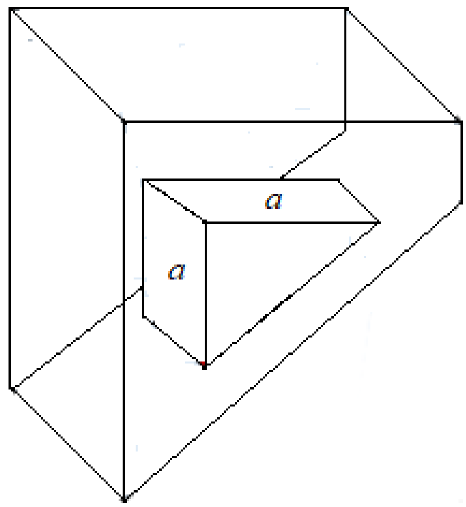

Figure 4.

Solution: Let us find the pressure force F_1 exerted by the water on the base of the prism: $F_1 = P_u S = \left(P_0 + \rho g h\right) S$ (1)

Since the pressure force F_2 exerted by the water on the lateral side of the prism is variable, we take the average of its maximum and minimum value:

$$F_2 = \frac{F_{\max} + F_{\min}}{2} = \frac{(P_0 + \rho g h)S + (P_0 + \rho g (h+a))S}{2} = \frac{2P_0 \ldots}{}$$ (2)

Let us represent the directions of F_1, F_2, , the normal pressure force, the friction force and the weight force in the diagram (Figure 5):

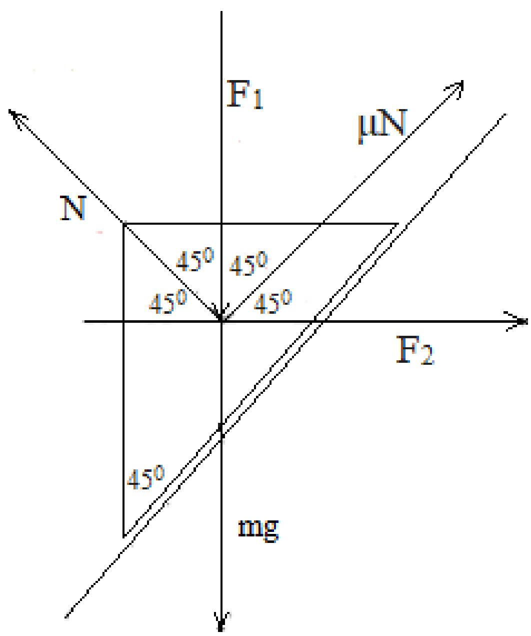

Figure 5.

Taking the projection of the normal pressure force and the friction force onto the Y-axis, we can write the following equation:

$$mg + F_1 = \mu N\cos 45 + N\cos 45 = N\cos 45(1+\mu) \qquad (3)$$

Taking the projection of the normal pressure force and the friction force onto the Y-axis, we obtain:

$$F_2 = N\cos 45 - \mu N\cos 45 = N\cos 45(1-\mu) \qquad (4)$$

Dividing equations (3) and (4):

$$\frac{mg + F_1}{F_2} = \frac{1+\mu}{1-\mu}$$

$$\frac{mg + F_1}{F_2} = \frac{1{,}2}{0{,}8} = \frac{3}{2}$$

$$2mg + 2F_1 = 3F_2$$

$$2mg = 3F_2 - 2F_1 \qquad (5)$$

If we substitute expressions (1) and (2) into (5), then:

$$2\rho_x g\frac{a^3}{2} = 3(P_0 + 0{,}5\rho g(2h+a)\,a^2 - 2(P_0 + \rho gh)\,a^2$$

$$\rho_x ga = 3P_0 + 1{,}5\rho g(2h+a) - 2P_0 - 2\rho gh$$

$$\rho_x ga = P_0 + \rho g(h + 1{,}5a)$$

$$4\rho_x = 10^5 + 8\cdot 10^3 = 108\cdot 10^3$$

$$\rho_x = 27000 kg/m^3$$

It is appropriate to select this type of problem in developing students' research abilities. In selecting the problems, the ability of creative thinking, which enhances research potential, was used, and the analysis of problems corresponding to this component was studied. The selected problems are considered the initial stage of developing students' research abilities. In this process, the student's research ability, in terms of its general structure, is similar to the structure of professional scientific work and includes the following main stages: identifying the problem on the basis of observation or logical analysis; formulating the problem, putting forward hypotheses and testing them; planning further work related to conducting experiments.

REFERENCES

1. Андреев В.И. Педагогика: Учебный курс для творческого саморазвития. [Текст] / В.И. Андреев. - Казань: Центр инновационных технологий. -2000. - 608 с.

2. Гальперин П.Я. Лекции по психологии. Учебное пособие для студентов вузов [Текст] / П.Я. Гальперин. — М.: Высшая школа. — 2002. — 400 с.

3. Мещеряков Б.Г, Зинченко В.П. Большой психологический словарь. [Текст] / М.: АСТ. - 2009. - 816 с.

4. Мухина В.С. Психологический смысл исследовательской деятельности для развития личности. [Текст] / В.С. Мухина // Школьные технологии. — 2006. — №2. — с. 19-31.

5. Теория и методика обучения физики в школе: Частные вопросы: Учеб пособие. / Под ред. С.Е. Каменецкого. - М.: Изд. центр «Академия». -2000. - 384 с.

6. Рыжиков С.Б. Проектно-исследовательские работы - как способ развития интереса к физике у школьников 7-9 классов. [Текст] / С.Б. Рыжиков // Всероссийский съезд учителей физики в МГУ. Труды. - М.: МГУ. - 2011. –с. 205-207.

7. Ibragimov N.Sh. Ta’lim jarayonida o‘quvchilarning matematik qobiliyatlarini rivojlantirish: Ped. fan. fal. dok. dis...si. – T.: 2021. – 122 b.

8. Bendirkov G.A. va bosh. Fizikadan masalalar to‘plami. – T.: “O‘qituvchi”, 1980. – b. 394.

9. Abdulhamidov A.F., Jabborov T.Y. Fizikadan ba’zi masalalarning maxsus yechimlari. – N.: 2020. – 133 b.