CAREER-ORIENTED TEACHING OF THE TOPIC “FORCES IN NATURE AND THEIR PRACTICAL APPLICATIONS” IN VOCATIONAL SCHOOLS

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Abstract: This article highlights the importance of developing professional competencies in future physics teachers through career-oriented teaching.

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Improving the quality of teaching subjects within the continuous education system and raising a well-rounded generation is a requirement of modern times. The use of modern pedagogical technologies in forming deep knowledge, skills, and competencies, as well as demonstrating their practical application, creates opportunities to improve the quality of education. Today, the issue of career-oriented teaching is also highly relevant. In particular, STEAM-based education aims to provide students with the knowledge and skills necessary to succeed in various fields. This approach not only supports the study of traditional subjects but also facilitates their practical and creative application.

Physics is one of the fundamental sciences that studies the laws of nature and serves as the scientific basis of all technology and production. In vocational schools, this subject provides not only theoretical knowledge but also develops practical skills directly applicable to students’ future professional activities.

Astronomy studies celestial bodies, the origin, structure, and composition of the universe, as well as the relationship between changes in celestial objects

and natural conditions on Earth. Therefore, in the process of teaching physics and astronomy in vocational schools, special attention is paid to:

- linking theoretical knowledge with practice;
- preparing students for professional activities;
- teaching effective use of modern pedagogical technologies and ICT;
- developing independent thinking, problem-solving skills, and creativity;
- using innovations in the field of astronomy.

In seminar classes on career-oriented teaching of physics and astronomy, students develop knowledge and skills related to connecting the subject matter with the specialties acquired in vocational schools. This strengthens their professional motivation. Accordingly, the **dynamics section of mechanics** was selected.

When teaching the topic *"Laws of Dynamics. Forces in Nature and Their Applications"*, it is important to reveal the physical essence of force, its types, and its practical significance.

Types of Forces

Students explain the types of dynamic forces in nature and science as follows:

1. Classical dynamic forces (Newton's laws, gravity, friction, elasticity, air resistance, centripetal force, etc.)
2. Forces identified through scientific research and observation:
   - Earthquake forces
   - Ocean waves and water currents
   - Wind-generated forces (energy)
   - Cosmic forces
   - Biological forces
   - Forces in modern technologies

Understanding the practical applications of these forces is of great importance.

Applications of Dynamic Forces

1. **Wind energy** is widely used today to generate electricity. Wind turbines convert air flow into kinetic energy.

2. **Ocean waves and water currents** are being studied as environmentally friendly energy sources. For example, projects exist in France and Japan.

3. **Earthquake forces**: Scientific studies show that dynamic forces during earthquakes can destroy structures; therefore, engineers design earthquake-resistant buildings.

4. **Cosmic forces**: During rocket launches, reactive force is involved. Artificial satellites remain in orbit due to centripetal and gravitational forces. According to NASA research, spacecraft are sent to Mars and other planets by calculating dynamic forces.

5. **Biological forces**: Hydrodynamic forces are involved when the human heart pumps blood. This knowledge is essential for medical professionals.

Dynamic Forces in Modern Technologies

- In automobiles, aerodynamic design reduces air resistance, increasing speed and fuel efficiency.
- In aviation, aircraft wings are designed based on aerodynamic forces. Today, even humans can fly using “artificial wings.”
- In sports, running, jumping, and swimming are based on dynamic forces. Scientists develop special clothing and footwear to reduce air resistance.
- Drones maintain balance in the air using aerodynamic forces.

New Scientific Approaches

- In nanotechnology, forces such as friction and attraction are studied at the molecular level.
- In robotics, dynamic forces are calculated using algorithms to imitate human movement.

- In energy, greater use of wind and water forces is planned in the future.

Future Importance of Dynamic Forces

- Production of environmentally friendly energy
- Space exploration
- Development of fast, safe, and efficient transportation
- Understanding human health (heart, circulation, muscle force)

Forces in Nature and Their Applications

1. Gravitational Force

In nature: falling rain, river flow, tides, planetary motion.**In practice:** space technology, hydropower, construction

Innovations:.NASA and ESA use gravitational slingshot methods to accelerate satellites. Projects are also being developed in Uzbekistan to forecast floods based on gravitational effects of the Moon and the Sun.

2. Friction Force

In nature: human walking, bird flight, animal movement.**In practice:** vehicle motion, braking systems, sports equipment

Innovations:.Magnetic (frictionless) bearings are being developed to increase efficiency and reduce energy loss. Special low-friction sportswear is also being produced.

3. Elastic Force

In nature: bending trees, muscles, natural springs.**In practice:** shock absorbers, sports equipment, earthquake-resistant construction

Innovations:.Engineers are developing “smart elastic materials” that change shape under temperature or pressure and recover afterward.

4. Air and Fluid Resistance

Used in aircraft, drones, rockets, ships, and submarines.

Innovations:.Modern electric aircraft are designed to minimize air resistance. Wind power plants are expanding worldwide, including in Karakalpakstan (Uzbekistan).

5. Centripetal and Centrifugal Forces

Used in washing machines, satellites, amusement rides, and sports.

In nature: planetary and lunar motion

Innovations:.Artificial gravity concepts in space stations and particle separation techniques in nanotechnology are being developed.

Conclusion

Natural forces are the foundation of human life and technological development..Yesterday they were only theoretical concepts,.Today they are applied in engineering, transport, medicine, energy, and space,.Tomorrow they will play a key role in clean energy, artificial gravity, and nanotechnology.

Case Studies

Case 1: Braking Distance

A 5-ton truck moving at 72 km/h stops in about 34 m ($\mu = 0.6$)..On icy roads ($\mu = 0.2$), the stopping distance increases to about 102 m.

Case 2: Elevator Motion

A person feels lighter when moving downward and heavier when moving upward due to changes in normal force.

Case 3: Rocket Launch. If thrust is less than gravitational force, the rocket cannot take off. For lift-off, thrust must exceed weight.

Case 4: Circular Motion. If friction is insufficient, a car will skid off a curved road.

Final Conclusion. The laws of dynamics are widely applied in human activity and technology. Newton's laws serve as the fundamental theoretical basis for analyzing motion in transport, elevators, space technologies, and mechanical systems.

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