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ENHANCING THE METHODOLOGY OF TEACHING THE PHYSICS COURSE THROUGH INTERDISCIPLINARY INTEGRATION (A CASE STUDY OF GRADE 7)

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Abstract
This article explores the principles, goals, and significance of interdisciplinary teaching in the context of school physics education. It presents a methodological framework for integrating interdisciplinary connections into the Grade 7 physics curriculum and offers practical recommendations for educators.

Keywords: Interdisciplinary teaching, physics education, educational methodology, cognitive skills, pedagogical strategies.

Introduction

Improving the education system has become a central issue in many countries, as education plays a decisive role in shaping a nation's cultural, spiritual, and socio-economic development. In the context of global transformation, education remains the most effective tool for equipping individuals with critical thinking, problem-solving abilities, and creative skills.

Globally, innovative educational reforms highlight the growing importance of interdisciplinary approaches. For example, Finland has introduced phenomenon-based learning in place of traditional subjects since 2016; the United States promotes interdisciplinary STEM education; South Korea implements Problem-Based Learning (PBL); and Singapore uses the Integrated Curriculum for Creativity (ICC). These approaches help students develop essential life skills and a deeper understanding of complex, real-world issues [1].

To remain competitive in the global education arena and improve student performance in international science Olympiads, Uzbekistan must also focus on fostering interdisciplinary thinking among students. However, in many general secondary schools, subjects are often taught in isolation, which hinders the

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development of holistic understanding. Traditional teaching methods, although based on years of experience, may lack an interdisciplinary perspective, resulting in decreased student engagement and limited cross-subject knowledge integration. The relevance of this issue is underscored by Presidential Decree No. PQ-5032, dated March 19, 2021, "On Measures to Improve the Quality of Education in Physics and Develop Scientific Research." The decree emphasizes enhancing physics education quality, strengthening teachers' pedagogical skills, and updating educational content and materials.

Methodology

The development of interdisciplinary integration in the teaching process relies on both pedagogical experience and scientifically grounded methods. Integrating physics with related subjects helps students develop a comprehensive understanding of natural phenomena.

A review of scientific literature reveals several influential perspectives on interdisciplinary teaching. For example, Ukrainian scholar I. Korsun argues that without explicit instruction, students struggle to establish meaningful links between subjects. Research indicates that interdisciplinary instruction increases student interest and engagement in physics [2].

In Interdisciplinary Studies published by the U.S. Education Center, educational theorist Applebee notes that although a universal definition of interdisciplinary learning is lacking, most definitions highlight its effectiveness in improving learning outcomes, fostering systemic thinking, and encouraging a holistic worldview.

Definitions by various scholars include:

- **Nakoji:** Interdisciplinary connection is the process of generating new concepts and solutions by combining methodologies from different fields.

- **Lajos:** An interdisciplinary approach is a didactic method that synthesizes diverse sources of knowledge to promote holistic thinking.

- **Fogarty:** Interdisciplinary integration involves breaking down subject boundaries and organizing content around a central theme or issue.

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- **Korsun:** Interdisciplinary integration represents the unity of knowledge necessary for perceiving the world as a coherent whole.

Author's Definition:

Based on practical implementation and effectiveness, interdisciplinary learning can be defined as a teaching approach designed to actively engage students by integrating knowledge and skills across multiple disciplines. Guided by specific learning goals, the teacher creates conditions that foster meaningful knowledge acquisition and skill development. Interdisciplinary teaching serves as a didactic principle that promotes inquiry, comparison, analysis of cause-and-effect relationships, and creative problem-solving.

Results and Discussion

To provide students with quality physics education, teachers must possess not only subject expertise but also methodological knowledge and an understanding of students' cognitive and psychological development. A physics teacher should create opportunities for independent inquiry, innovative thinking, and personalized learning.

By employing diagnostic tools such as questionnaires, tests, and interviews, teachers can identify students' interests and tailor instruction accordingly. Integrating physics lessons with real-life applications and other subject areas, such as technology, geography, and biology, helps spark curiosity and foster deep understanding.

Physics as a discipline is inherently interdisciplinary, and its teaching should reflect this nature. However, interdisciplinary connections do not emerge automatically—they require deliberate planning and structured implementation. Learning subjects in an integrated manner enables students to understand concepts more deeply and prepare them to meet the demands of modern education and future professions.

To effectively implement interdisciplinary integration, physics teachers must design lesson plans that incorporate concepts from related subjects and build upon students' existing knowledge. In this study, we developed a detailed framework for aligning Grade 7 physics topics with content from other disciplines. These interdisciplinary mappings are compiled in a methodological guide, which is recommended for use by physics teachers in secondary schools [3].

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Interdisciplinary Connections of the Topics in the 7th Grade Physics Textbook

Topic	Mathematics	Natural Sciences	Geography	Biology	Chemistry
Mass and Its Units	Mass, kilogram, gram, ton, centner	The relationship between mass and weight (6th grade)	Mass of rock formations	Animal weight and bone mass	Atomic mass of chemical elements
Atmospheric Pressure	Pressure formulas and unit conversions	Atmosphere. Layers and composition of the atmosphere. How is it studied? (4th grade)What is the atmosphere? Its benefits for humans (5th grade)	Structure of the atmosphere, pressure, and air mass movement	Adaptation of humans and animals to atmospheric pressure at altitude	Compression and expansion laws of gases
Evaporation and Condensation	Graphical representation of changes in the states of matter	What happens during evaporation? Factors affecting the rate of evaporation. How does condensation occur? (5th grade)	Cloud formation, rainfall, and snowfall	Sweating and cooling processes in the human body	States of matter and their transitions
Reflection and Refraction of Light	Angles, degrees, types of angles, straight and curved lines	Light phenomena (4th grade)Reflection and refraction of light (6th grade)	Solar and lunar eclipses, rainbow formation	Importance of light for humans and animals. Structure of the eye and light reception	Density of substances – light refraction
Pure Substances and Mixtures	Classification, sets, proportions	Difference between pure substances and mixtures. Observable changes (5th–6th grade)	Natural distribution of mixtures and substances	Body fluids as mixtures (e.g., blood, lymph)	Composition and separation of mixtures, solubility

Discussion

Particular attention is being given to the use of innovative methods in the interdisciplinary teaching of the physics course, integrating it with students' scientific worldview, and improving its didactic support. Especially, teaching the laws of electric current through interactive and interdisciplinary approaches contributes to developing students' abilities to solve modern scientific and technological problems, implement energy efficiency, and create competitive technologies [4].

The difference between traditional and interdisciplinary teaching methods in physics can be outlined as follows:

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In traditional teaching:

- Each subject is taught separately, and teachers act independently;
- Students' interest in the subject is uneven and passive;
- Teachers' self-improvement is irregular and limited;
- The teacher is a guide, and the student merely follows;
- Independent thinking and explaining the relationship between phenomena are underdeveloped;
- The main focus is on acquiring physical knowledge only;
- Assessment is based on individual subjects or topics;
- Knowledge is fragmented and lacks integration;
- There is little or no support for developing professional skills;
- The ability to scientifically explain reality is limited.

In interdisciplinary teaching:

- Collaboration among teaching staff is strengthened;
- Teachers' professional development is continuous and dynamic;
- The teacher becomes a facilitator, and the student takes on the role of an explorer;
- Students demonstrate stronger independent thinking and clearly explain relationships between phenomena;
- Both physical and vocational knowledge are integrated;
- Assessment is systematic and interdisciplinary;
- Curiosity and comprehensive understanding are encouraged;
- Professional skills and competencies are actively developed;
- Students gain deeper knowledge about the interrelation and development of events and phenomena;
- Their worldview is formed in alignment with philosophical principles.

In conclusion, organizing physics lessons on the basis of interdisciplinary integration plays an important role in enhancing the quality and effectiveness of the learning process. This approach allows students to understand physical phenomena not only in a theoretical framework but also in connection with real-life situations and other academic disciplines. Interdisciplinary integration develops students' analytical thinking, comparison skills, problem-solving abilities, and fosters creativity in their independent learning activities.

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