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# METHODS OF DEVELOPING INTERDISCIPLINARY COMMUNICATION IN TEACHING NATURAL SCIENCES

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## ABSTRACT

This article is an answer to a problem that has not been solved in universities in Kazakhstan. After the independence of the Republic of Kazakhstan, our universities have been studying methods of pedagogical development in teaching Social Sciences in The Bachelor's degree. The goal of the modern education system is to train a competitive specialist. The school is a teaching environment, its heart is a teacher. A special feature of the creative work of an inquisitive teacher is his ability to transform the lesson and find the way to the heart of the individual. For this purpose, we want to highlight the main features of interdisciplinary communication. Therefore, to combine their functional literacy with professional skills, it is necessary to have an andrological process that purposefully educates, forms, and develops in a result-oriented educational model. In other words, education for adults, in order to stimulate cognitive activity aimed at developing the general culture and social activity of people through the development of the need for general and professional education, the achievements of Science, Education, and culture. The modern educational paradigm provides for the transition from education aimed at a" qualified person "to education aimed at a" cultural person". This education requires a new organization - a deeper revision of its philosophical, psychological, pedagogical Foundations, Theory, and practice. Therefore, today in the country's education system, the task is to ensure a new content of the learning process based on new ideas.

**Keywords:** Interdisciplinary Communication, Science, Competence, Training Program, Innovation.

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# DOĞA BİLİMLERİ ÖĞRETİMİNDE DİSİPLİNLER ARASI İLETİŞİMİ GELİŞTİRME YÖNTEMLERİ

**ÖZET**

Bu makale Kazakistan'daki üniversitelerde çözülmemiş bir sorunun cevabıdır. Kazakistan Cumhuriyeti'nin bağımsızlığından sonra üniversitelerimiz Sosyal Bilimler öğretiminde pedagojik gelişim yöntemlerini Lisans düzeyinde incelemektedir. Modern eğitim sisteminin amacı rekabetçi bir uzman yetiştirmektir. Okul bir öğretim ortamıdır, kalbi bir öğretmendir. Meraklı bir öğretmenin yaratıcı çalışmasının özel bir özelliği, dersi dönüştürme ve bireyin kalbine giden yolu bulma yeteneğidir. Bu amaçla disiplinler arası iletişimin temel özelliklerini vurgulamak istiyoruz. Bu nedenle, işlevsel okuryazarlıklarını mesleki becerilerle birleştirmek için, sonuç odaklı bir eğitim modelinde kasıtlı olarak eğiten, şekillendiren ve geliştiren androlojik bir sürece sahip olmak gerekir. Başka bir deyişle, yetişkinler için eğitim, genel ve mesleki eğitim ihtiyacının geliştirilmesi yoluyla insanların genel kültürünü ve sosyal faaliyetlerini geliştirmeyi amaçlayan bilişsel aktiviteyi teşvik etmek için Bilim, Eğitim ve kültürün kazanımları. Modern eğitim paradigması," nitelikli bir kişiye" yönelik eğitimden" kültürel bir kişiye" yönelik eğitime geçişi sağlar. Bu eğitim yeni bir organizasyon gerektirir - felsefi, psikolojik, pedagojik Temellerinin, Teorisinin ve pratiğinin daha derin bir revizyonu. Bu nedenle, bugün ülkenin eğitim sisteminde görev, yeni fikirlere dayalı öğrenme sürecinin yeni bir içeriğini sağlamaktır.

**Anahtar Kelimeler:** disiplinlerarası iletişim, bilim, yetkinlik, eğitim programı, yenilik.

## 1. INTRODUCTION

The education system (APZ RK2004 ) is a set of educational programs that have continuity and a system of state educational standards of different levels and directions, branches that implement them in educational institutions of various organizational legal forms, types and types, as well as a system of Educational Management Bodies. The education system plays a leading role in the socio-economic development of society, as well as its further definition. And the general conditions for the formation and development of knowledge the teaching that is studied from the main problem of philosophy – the relationship of spirit to matter, consciousness to being-is called the theory of knowledge. The fundamental difference between the theory of knowledge and other scientific theories is that it forms general principles of formation and justification of knowledge, objective relationships.

Our main goal is to develop a method of using creative problems in the integration of physics in the classroom, that is, to engage students in the subject. To achieve this goal, we focus on the development of students' thinking, the comparison, analysis, grouping, summarization of creative problems encountered in the educational material. Providing creative experience of knowledge, experience of emotional and value attitude to the world is of great importance for the development of the student. We also pointed out that for the personal development of the student it is necessary from the object of his educational process to become a subject of active interaction with the teacher (G.K. Zhusupkalieva, A.A. Dzhumasheva, B.S. Kubayeva, 2012).

In this sense, the development of the student's personality, first of all, presupposes the development of his/her thinking. Thinking is the highest stage of the process of depicting an objective reality, human cognition.

Therefore, a new system of education is being developed in our modern Republic, and bold steps are being taken to enter the world educational space. There is a need to update the content of education and improve them technologically and pedagogically. In this regard, we believe that we need to determine the interest of students in creativity.

In the development of physical thinking, students are taught to think dialectically, to discover the secrets of physical phenomena (e.g., Archimedes' force, electromagnetic waves, radio communication, etc.), to study unresolved issues and turn them into complete knowledge (atomic and the construction of the nucleus, the launch of spacecraft, television broadcasting, etc.) and reveal the relationship of physical laws (gas laws, uranium chain reactions, etc.).

When it comes to the interconnectedness and harmony of natural phenomena, it is important to remember that education should teach students to see and understand the internal, meaningful interrelationships of physical phenomena and processes. For example, the relationship between thunder and lightning is clear to lower grades. However, the properties of these natural phenomena can be revealed by analyzing and comparing the essential properties that determine them. In this sense, it can be seen that the teaching of Physics is related to the subject of Geography. The nature of the relationship and mutual agreement, development and direction of physical phenomena - in Physics is determined primarily by the relationship between physical quantities. One of the main concepts of physical science is the concept of physical quantity, which determines the qualitative and quantitative diversity of a physical object or its various properties.

Science is an enormous enterprise that depends on nations to move forward technologically. Therefore, science pays gorgeous attention to education due to its importance and importance for life and society. Computers and ICT tools offer amusing ways to learn that no one dreamed of many years ago. The use of computers can revolutionize teaching and learning and lead to progress that significantly improves education. According to this approach, educational institutions argued that they would face difficulties in preparing a new generation of teachers for the effective use of ICT in their pedagogical practice. The education system in each country strives to provide young people with the fundamental skills they need in the modern world and arm them for logical solutions to problems (Amusan, O.O.C. 1992).

According to the Russian teacher K.D.Ushinsky (1857-1958), the lesson will be attractive, meaningful, reasonable, and efficient if, following modern requirements, every teacher improves their knowledge and uses innovative technologies in their lessons daily, rather than the old monotonous lessons.

This is stated in Article 8 of the law of the Republic of Kazakhstan "on education" (2007 No. 546) "one of the main tasks of the education system is the introduction of new learning technologies, informatization of education, access to international global communication networks".

As the head of State N. A. Nazarbayev said in his address: "to enter the ranks of educate developed countries in the future, modern education is necessary. It is education that will bring Kazakhstan to the top 50 developed countries."

The education system of the Republic of Kazakhstan covers about a thousand levels of Education based on the principle of excellence and continuity of educational programs:

1) pre-school education and training;

2) provides education for beginners;

3) Basic Secondary Education;

4) Secondary Education (General Secondary Education, Technical and vocational education);

5) post-secondary education;

6) higher education;

7) postgraduate education.

Therefore, the current stage of development puts before the education system the problem of technologization of the learning process. Various teaching technologies are analyzed, the experience of innovative teachers is studied and introduced into the life of the school.

Science consists of knowledge, skills, and views, each of which covers different areas. For example, knowledge covers the cognitive sphere, and skill covers the cognitive and psychomotor spheres. This is because the science of skills includes critical thinking in attribution (cognitive field). Each of these areas is served in the educational process. It is possible to define scientific education as a subject or field of research related to the integration of the content and processes of Science with pedagogy in order to promote a meaningful understanding and application of science among students or to study the content and process of Science with an emphasis on how best to promote their teaching and training in order to achieve optimal benefits.

## 2. THEORETICAL METHODOLOGY

The draft state program for the development of education in Kazakhstan for 2011-2020 pays superb attention to the issues of providing students with high - quality education in Kazakhstan, improving the indicators of education in international ratings, and increasing the attractiveness of the Kazakh education system, first of all, increasing the status of teachers, ensuring their career growth, training, and professional development throughout their activities, as well as increasing state support and motivation for the work of teachers. In this regard, reforms and modern policies, changes, and innovations in the education system of the country are the basis for the thinking of every teaching community, thinking about the past and present, prospects and prospects, working with new ideas and new systems. Therefore, the quality and conscious transfer of knowledge depends on the level of teachers and intellectuals in the education system. In the traditional education system, the main goal of professional educational institutions that train qualified specialists is only to master specialties, and now, joining the World Educational Council, to provide a result – oriented education system based on the competence of a person to train a capable person is one of the most pressing issues at the

moment. On the concept of" competence "in general, the scientist K. Kudaibergenova (2007) said:" the concept of competence is a concept that has been introduced in recent years in the field of pedagogy as a result of special attention to the subject experience of the individual.

All branches of modern science are closely interconnected, so the subjects taught at school can not be separated from each other. Integrated learning is a didactic condition and tool for in-depth and comprehensive study of the basics of science at school. As an exemplary teacher, it was expected that the teacher would be a person with a critical and creative approach to solving problems arising from students and create a positive learning atmosphere (Rifandi, and Rahmi, 2019). Article 293 of the Law of the Republic of Kazakhstan of December 27, 2019 states that the Law “On the status of a teacher” aimed at “the implementation of creative initiatives, the development and application of author's programs and methods of teaching and education, the development and dissemination of new, more advanced methods of teaching and education, in compliance with the requirements of the state mandatory standard of education” (Law of the Republic of Kazakhstan, 2019). In this regard, the school teacher considers ways to develop students’ creativity in accordance with modern requirements.

It has been found that the interest in the study of creativity can be explained by the need to develop behavioral characteristics in relation to human potential and positive aspects of the individual (Nakano and Wechsler, 2018). This characteristic is assessed in terms of personal and professional achievement (Wechsler & Nakano, 2018), as well as the importance of increasing personal well-being in important contributions to the learner (Krentzman, 2013). The most important and interesting innovations in the development of science are made in the search for science, and many sciences are difficult to understand, so the organization of interdisciplinary links in teaching is especially important (Yermekova et al, 2021). For this purpose, in the integration of Physics, creative problems can be taught in conjunction with other disciplines: mathematics, computer science, geography and chemistry.

In fact, the knowledge imparted by a teacher in the Natural Sciences and Mathematics is only a source of information, making it difficult for learners to find and learn knowledge or information on their own. As a result, the quality of education is declining. Students do not understand the scientific steps in the formation of their knowledge, so they could not describe the process of solving problems. We know that creativity and its promotion are common issues in the field of education. However, it has been found that little effort has been made to implement intervention programs aimed at stimulating creativity and other aspects (e.g., academic motivation) (Kaufman, Beghetto, & Pourjalali, 2011). In this regard, he noted that education plays a key role in ensuring that future generations are able and well prepared to solve the problems of the XXI century (Husin et al, 2016).

He Latin translation of competence indicates that "competence" means that a well – informed expert in a particular field can make authoritative decisions on certain issues, including their meaning." According to the Russian scientist N. Kuzmina (2002), "competence is the knowledge and dignity of a teacher that can serve as the basis for the development of another person."

The concept of 12 - year education of the Republic of Kazakhstan states that the formation of professional and personal competencies of teachers is the main thing goal, and in 12-year education, it is mandatory for a teacher to master the following competencies.

1. special competence - the ability to project their professional development.

2. Social Competence - the ability to engage in professional activities.

3. educational competence - the ability to apply the basics of pedagogical and Social Psychology.

Therefore, competence can be understood as the ability of the teaching community to change itself following modern requirements. It is clearly stated that fundamental changes in the education policy should begin with tasks that are given in the daily learning process. Students need not only knowledge but also the ability to teach life. Therefore, our time requires that our future teachers, without lagging behind this information society, are: quick - thinking: quick - decision-makers: with exceptional organizational abilities: specific guides.

The teaching methods adopted by teachers affect the learning style of students and the acquisition of scientific skills that are necessary for the achievement of scientific and technical achievements in Kazakhstan. Besides, these are active learning methods that involve the student in the educational and cognitive process. Osuafor (1999) listed some activities based on the teaching methods promoted by scientists based on the results of the study, and these include Discovery, problem-solving, collaborative learning, excursions/field trips. Others include teaching methods such as concept mapping, demonstration, laboratory research, and problem-solving techniques.

As the awareness of Science and technology increases, it is clear that the curriculum and methodology of scientific education increase to follow the upcoming trends, linking the curriculum with the environment and society.

## 3. IMPROVING THE TEACHING AND DEVELOPMENT OF NATURAL SCIENCES THROUGH INTERDISCIPLINARY COMMUNICATION.

We know that scientific knowledge consists only of studying theories and laws. It also includes the study of how to initiate functional integrative associations between the natural sciences curriculum and other curricula that arise when providing people with a solid technological basis to acquire the necessary knowledge, skills, and attitudes in the world.

First, the concept of interdisciplinary communication science is one of the most important disciplines focused on teaching scientific courses, along with other courses such as Social Research and linguistic research (Glatthom 2000). In the development of scientific methodology, science curricula are expected to be more related and integrated with technology, mathematics, social sciences, ecology, medical education, and other curricula (Opara et al, 2010a).

Secondly, there are innovative approaches to the development of the methodology of interdisciplinary communication science. The ways of development of this approach are as follows:

1. Comprehensive scientific approach: reflects a comprehensive scientific approach based on the development of society and progress in social, economic, political, and cultural life as a new direction in the field of science. Numerous studies confirm the effectiveness of a comprehensive approach that meets traditional approaches aimed at considering the subject as a single coordinated unit, far from dualism and duplication.

2. Environmental approach: interdisciplinary communication is considered appropriate for the systematization of scientific training programs. It recognizes its place in the life of the child and in general well-being. Therefore, the child's education is always designed in such a way that it corresponds to his environment. It should be, among other things: it instills the spirit of study and creativity of social norms through the study of nature, the environment, art, music, and Toy Games, etc. Civic approach: this approach helps citizens understand analytical thinking, as well as the past as a guide for assessing the present. The scientific curriculum, which seeks to introduce scientific enlightenment and civilization, combines science and Technology, Society, and the environment in a dynamic, stable relationship with the real world.

3. Systematic approach: there is a problem of attitude to science, where students believe that scientific disciplines are too complex and therefore reject them. This process allows the student to move on to the next stage of the learning process at their own pace. This encourages the learning of concepts and topics through an integrated system and allows the student to establish connections between different disciplines.

4. Approach to real life: allows students to understand social problems and problems related to their real-life, solve these problems. It is necessary to link scientific training with reality, and the real-life situation of the student with attention to the social dimension.

5. Approach to Science, Technology, and society: an interdisciplinary science curriculum is essential for improving personal literacy through an approach to science, technology, and society. In a precise translation, it is science and technology that can solve the problems of society caused by nature or nature itself. Therefore, science and technology are an integral part of society. So there is a link between science, technology, and society that is difficult to break. Society is becoming more dynamic and complex. As complexity increases, science and technology improve but become simpler. This approach has attracted more and more attention from science researchers in national and international environments, as many studies are being conducted in this area.

**The Role of Science Education:** Scientific education has been recognized all over the world as the basis for scientific and technical achievements and development, so teachers of Natural Sciences are increasingly engaged in ways to improve the quality of teaching and teaching natural sciences at a high level in schools;

1. Education necessary for Cultural Development. It expands man's knowledge of the universe and his place in it. This will help you appreciate and enjoy nature and life.

2. It provides many opportunities for the development of scientific method and discipline, as it teaches students to think clearly and carefully. This training should be applied as much as possible to specific and significant problems that affect a person's personal life and thinking so that such benefits can be transferred to other types of activities.

3. It emphasizes the need to evaluate the meaning of scientific life, spirit and aspiration, an open mind, intellectual honesty, selflessness, and honesty, which should serve as an idea for future citizens.

4. Science introduces a person not only to many professions and professions but also to the knowledge of chemical facts so that all citizens can live a happy, balanced, and useful life.

## 4. APPLICATION OF AN INTERDISCIPLINARY APPROACH TO FORM STUDENTS ' INTEREST IN THE SUBJECT.

Physics has interdisciplinary connections with many school subjects because physics is the fundamental science. Each student has their favorite subjects or hobbies (for example, football, figure skating). Therefore, knowledge of these favorite subjects can serve as the basis for forming a student's interest in physics. Examples of related topics are shown in Table I. We will consider the use of an interdisciplinary approach to form students ' interest in physics.

**Table 1: Topics Related to Physics**

| School subjects | Theme | Subject of physics |
|---|---|---|
| Mathematics | 1.Function | Equation of body motion and motion graphics |
| | 2. Scalar and Vector quantities | Work, Power |
| | 3. Scalar value | Mechanical work |
| | 4. Quantity | Speed, acceleration |
| | 5. Integral | Quantitative cost of work |
| Astronomy | 1. Movement of celestial bodies | The law of universal gravitation |
| | 2. Solar energy | Thermonuclear reaction |
| | 3. Rocket flight | The law of conservation of imupulse |
| | 4. Observation of celestial bodies | Telescope |
| | 5. Study of celestial bodies | Radiation, Spectra |
| Chemistry | 1. Atomic and molecular theory | Kinetic Molecular Theory of Matter |
| | 2. Periodic Table of elements | Atomic number, mass number, charge number |
| | 3. Electrolytes | Laws of Faraday electrolysis |
| | 4. Isotopes | Radionuclides |
| | 5. Exothermic reactions | Nuclear reactions |
| Biology | 1. Photosynthesis | Quantum properties of light |
| | 2. Thermoregulation | High temperature |
| | 3. Biopotential | Electric charge |
| | 4. Plants | Capillary phenomenon |
| | 5. Human vision | Lenses |
| Geography | 1. Atmosphere | Atmospheric pressure |
| | 2. Northern Lights | Earth's magnetic field |
| | 3. Geysers | Interaction of liquids and gases |
| | 4. Volcanoes | Aggregated States of matter |
| | 5. Earth quake | Infrasound |

Students of the South Kazakhstan State Pedagogical University found that they can be motivated by various teaching methods based on their actions. We have proposed the use of problem-based learning, project learning, teamwork, demand-based learning, an interdisciplinary approach, experiments from very simple and inexpensive experiments to computer experiments, and remote laboratories. According to this approach, we analyzed the work of scientists (Shanin SV, 2015). This allows us to identify the forms of interdisciplinary connections in teaching physics these forms are shown in Figure 1.

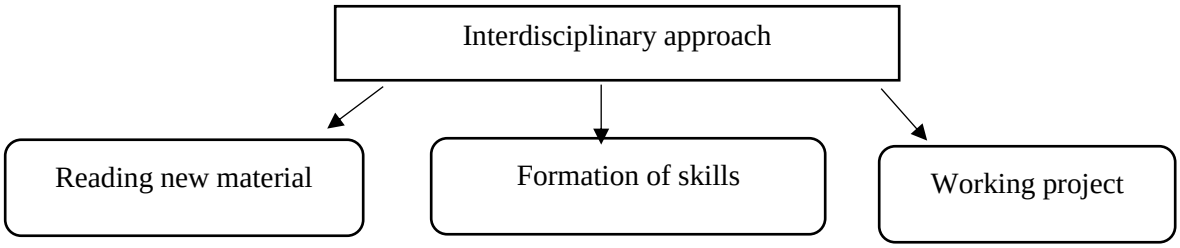


**Figure 1: Forms of Interdisciplinary Connections in Teaching Physics**

Schraw, Flowerday, and Lehman (2001) developed and demonstrated six specific recommendations for increasing interest in the subject, such as providing students with meaningful choices; using well-organized texts; choosing bright texts; using texts that students know, encouraging students to actively learn, and advising students on their importance. Following these specific recommendations, we have analyzed the proposed forms of interdisciplinary connections in teaching physics. This helped identify the tools for generating students ' interest (Figure 2).

қызығушылығын қалыптастыру құралдарын анықтауға көмектесті (2-сурет).

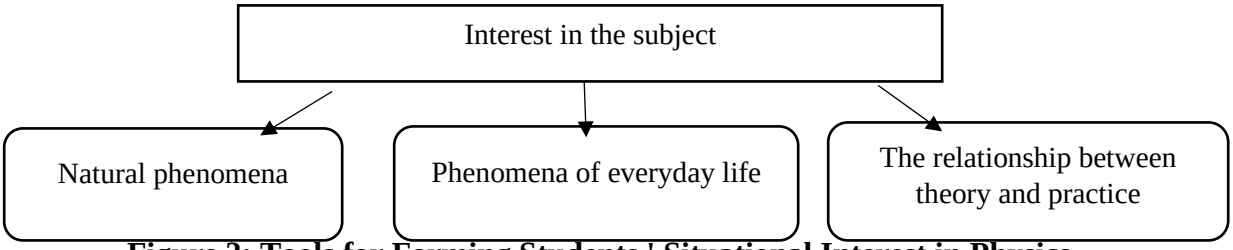


**Figure 2: Tools for Forming Students ' Situational Interest in Physics**

Why is it necessary to use an interdisciplinary approach let's briefly focus on the concept:

1. Interdisciplinary communication in the methodology of Science Science increases the level of learning of students. Help them develop knowledge, understanding, problem-solving skills, self-confidence, self-improvement, and a passion for learning.

2. Helps students identify hypocrisy or recognize hypocrisy. First, to help students identify ideas from several subjects that contribute to understanding the problem. Secondly, the development of the ability to integrate concepts and ideas from these disciplines into a broad conceptual framework of analysis.

3. Help students acquire positive trends and attitudes to the environment that help them adapt to the modern world.

4. It helps promote critical thinking and cognitive development. Getting a clear understanding of issues of importance in different disciplines requires the ability to combine ideas, and these skills are developed through interdisciplinary scientific training.

## 5. CONCLUSION

Traditional methods of teaching and studying science are not able to train a competent person who can observe the scientific and technical challenges of the modern world. The approaches are interrelated, although they are discussed differently. To prepare individuals for the fight against the modern world, it is necessary to create an integrated functional link between the natural sciences curriculum and other training programs. Given the role of scientific knowledge in the new world of globalization and sustainable development, interdisciplinary science is a useful and appropriate solution to achieve these goals.

This study is very important for teachers of Natural Sciences, as it shows the usefulness of a new structure - the prospect of integrating knowledge-for the description and analysis of the knowledge of future teachers and their development. This article focuses on developing learning ideas, although the lens can also be used to analyze the development of other aspects of Teacher Education. "I don't know," he said. Since they study scientific content at the time they learn, the study of their knowledge of educational ideas necessarily includes the study of their developing subject knowledge. Traditionally, relatively simple approaches have been used to describe teacher education.

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