

## BASIC COMPETENCIES THAT SHOULD BE DEVELOPED IN PHYSICS TEACHERS

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**Abstract.** *The article deals with issues related to the formation of basic competencies that should be developed by a physics teacher.*

**Keywords:** *competence communicative competence, integrative knowledge, technological approaches, model.*

Based on the goals of physics education, the following are defined as the main tasks of physics education: to teach students physical phenomena, concepts, quantities, models, laws, measurements, practical applications of physics; to independently work on problems from physics, to observe and explain physical phenomena, to form skills; to acquaint students with the development of science and technology, the practical application of the laws of physics; to introduce the activities of our great thinkers and physicists of our country at the present time, to educate students in the national spirit by enriching the content of education with the environment; to consciously direct students to the profession by connecting the educational content with social life and technical progress; It consists of forming the skills of using physics-related tools and equipment, performing simple measurements and experiments, drawing conclusions based on their results, and observing safety rules.

*Competencies* that should be developed in the process of teaching physics are knowledge, practical, research and educational and informational competencies. In a physics teacher, these competencies can be developed only in the experience of his work.

The competence of a physics teacher is manifested in the demonstration of knowledge and relevant skills in a specific work, which excludes the simple repetition of certain isolated knowledge from physics. The professional competence of a physics teacher can be manifested as a quality characteristic of a teacher's personality, which includes a system of scientific and theoretical knowledge, including special knowledge in the field of physics, professional skills, experience: professional development or complete retraining; quick assessment of the situation and their capabilities; independent study; decision-making and responsibility for them; adaptation to changing living and working conditions; developing new ways of working or changing old ones to optimize them.

Science competencies of a physics teacher represent an adapted system of: scientific knowledge; activity paths (ability to act according to the model); experience of creative activity in the form of the ability to make effective decisions in problematic situations; experience of emotional and valuable attitude to nature, society and man; culture of communication with students; the ability to obtain information on one's subject; turning it into teaching content; ability to convey information to students.

Methodological competence of a physics teacher. Science competence is one of the main components of the professional competence of a physics teacher and reflects the availability of the necessary professional knowledge (in this case, knowledge of physics). The formation of science competence smoothly transitions to the development of methodological competence of a physics

teacher. Methodological competence of a physics teacher includes methodical knowledge, professional and methodical skills (formulation of final and intermediate goals, ability to plan, conduct and analyze a lesson, establish and implement interdisciplinary connections).

Pedagogical competences of a physics teacher are to acquire the methods of scientific knowledge of the world, to observe and conduct experiments, to make measurements, to process and explain the results of laboratory work; to have the basic concepts and laws of physics, to understand the physical meaning of concepts and quantities, to have an understanding of physical phenomena, laws and theories.

The modern lesson is based on the principle of systematic activity. After determining its purpose, it is necessary to consider the method and technology, the means of achievement, the activities of subjects and methods of assessment, as well as the competencies that must be formed in students. The teacher should guide the learning process by inspiring the students. Here are the words of William Ward: "The average teacher explains. A good teacher explains. A famous teacher will show. It is intended to adhere to the belief that a great teacher inspires", that is, the teaching process will be aimed at forming competencies in students.

For example, after the topic "Pressure" has been covered by the physics teacher, giving the following assignments will help the students to understand the essence of the issue and the possibilities of applying this topic in everyday life, as well as to motivate them.

**Task 1.** What do you mean by pressure being directly proportional to the applied force and inversely proportional to the surface area? Tell me the meaning.

**Task 2.** At what times can human body pressure increase or decrease? Please explain.

Through such problematic questions of the physics teacher, the development of the students' competence in science is achieved in the lesson, and basic competencies related to working with information and universality are formed. A student's logical, critical thinking is the basis and component of independent thinking. Therefore, the systematic organization of the process of teaching them to think critically makes it possible to develop their communicative competence. At the moment, the main task of teaching students to think critically requires the ability to solve the problems that every person faces in today's life, to have active civic competence.

The effectiveness of using competence-oriented problem tasks in the development of basic and subject-related competencies of the physics teacher is evaluated through the strong influence of physics on technique and production. In general, in the use of a competency-based approach to the teaching of physics: a physics teacher should be able to observe, understand and explain processes and phenomena; perform laboratory work correctly; conduct experiments, measure quantities and draw conclusions; it is necessary to take into account the development of the competencies of using tools in practice. One of the effective methods for developing these competencies is conducting experiments, which has several didactic functions, such as: to interest students in physics, to teach them to work independently, and to support the formation of science-related competencies.

In mastering physics and developing students' competence, the physics teacher should pay special attention to the development of their logical thinking. For example, why can't a nail be melted in a candle flame? Many people answer this question that the temperature of the candle flame is not enough to melt the nail. But the temperature of the candle is around 1600 0C, and the melting temperature of iron is close to 1500 0C. Such assignments can be used as summarization, control, homework, and in the formation of students' motivation.

There are so many external factors that affect the student's attitude to the environment, thinking, worldview, finding his place in society, and his formation as a person in general, that the competence approach is considered as a solution to global problems, such as extracting the necessary information from them, effectively using the existing information base. For example, the physics teacher on the topic "Mechanical energy" below. By creating such a problem situation, students can be motivated and students' competencies can be formed. In the study of this topic, students are formed basic competences by finding, choosing and using energy sources effectively, analyzing the properties of energy, its importance in human life, and its use in everyday life.

Energy is the source of life. Information about its incomparable role in life, technique, technology and production is provided, and students are tasked with finding new information. Through this, the competence of working with information is formed in students.

The main need of the state is specialists with the required level of qualification. In the future, a graduate of the higher education institution in the field of medicine must begin to perform his professional duties, that is, he must have the appropriate professional competencies. However, in practice, problems often arise when they cannot perform their professional activities with the appropriate level of independence, when they do not meet the requirements and needs of employers who order personnel.

The main goal should be the comprehensive use of various pedagogical approaches and teaching technologies in the modern education system, the constant search for means and methods of creating conditions for the effective formation of professional competences, and the development of professional qualities of future specialists.

Special attention is paid to formation and development of competences abroad [1]. In particular, in the Netherlands, an educational system aimed at developing the following competencies in students has been created: strategic competence aimed at developing future-oriented skills; subject competencies related to knowledge and skills related to the nature of the studied subject; methodical competence, which consists of management skills in terms of content; basic structural cooperation skills, accepting criticism, establishing feedback; social-competence, which is moral-cultural competence. They include professional attitudes, motivation, readiness to achieve results, and learning competencies that determine the development of learning skills and reflection. The following basic competencies are distinguished in the Austrian education system: competencies focused on personal development; social and occupational competences. Competencies related to activities in a certain field - language and communication skills; creativity and design; man and society; health and movement; nature and technique and social competences include communication skills, ability to work in a team, ability to resolve conflicts, understanding others, initiative, social responsibility. Six core competencies are taken as a basis in British schools. They can be conditionally combined into several groups. Basic competences: communication; accounting; is information literacy.

Core competencies mean "before the subject", "on the subject". The reason for this is that in order to successfully live in society, a person must have certain abilities, skills, and abilities. In particular, to be able to express one's opinion fluently and intelligibly verbally and in writing, to be able to find and use necessary information, to be active in society, to have such characteristics as continuous self-development. Academician of the International Academy of Pedagogical Sciences, Doctor of Pedagogical Sciences A.V. Developed by Khutorsky [2].

They are: dignity, faith, general cultural, educational, informational, communicative, social work and personal improvement competencies.

Formation of general competencies and 6 basic competencies in physics students is envisaged. At the beginning of the academic year, it is important to determine the level of competences related to the subject and the basis of the students. During their time in school, students have acquired some knowledge of physics through a course in natural science and elementary geography. For example, those who learned information such as the globe, its atmosphere, its parts, and the formation of winds. In the teaching of physics, it is easy to study subjects such as the concept of mass, atmospheric pressure, Torricelli's experiment, measurement of atmospheric pressure, barometers, the phenomenon of convection in the ocean and seas and air, water circulation in nature, relying on the knowledge provided through these subjects. When studying topics such as "Universe structure", "Light phenomena", "Earth's rotation around its axis and the sun", "solar and lunar eclipses", the information obtained from geography can be used to form competences related to the subject.

It is also important for physics teachers to show students where to get physics-related materials on the Internet, what additional literature is available, and similar sources of information. Introduction of new concepts of physics in each lesson, etc.

No	Competencies	Content
1.	Observing and understanding processes and events.	Mechanical motion, interaction of bodies, diffusion, heat motion, convection, radiation, heat transfer, atmospheric pressure, movement of liquids and gases, evaporation, condensation, boiling, vibrations and waves, sound, free fall of bodies, inertia, deformation, elasticity, friction, melting, solidification, aggregate states, electrification of bodies, interaction of charges, short circuit, lightning, thunder, effect of electric current, interaction of magnets, Earth's magnetic field, phenomenon of electromagnetic induction, propagation of light along a straight line, reflection and refraction of light, light phenomena of interference, dispersion, diffraction, formation of an image in a lens, etc.
2.	Measurement and determination of quantities.	Measurement of some parameters of processes and events during observation; to know physical concepts and the description of quantities; formulas connecting this quantity with other quantities; units of physical quantities; types of size measurement; errors in measuring physical quantities; to be able to measure directly determined physical quantities with instruments; determination of physical quantities that can be calculated indirectly using physical tools.
3.	Explaining processes and events.	Conditions for the occurrence and occurrence of physical processes and events, the relationship of these events with other events, processes and events based on physical laws (Newton, Archimedes, molecular-kinetic theory of matter, Coulomb, Ampere, Joule-Lents, conservation and circulation of energy, etc.) scientific explanation.
4.	Conducting experiments and drawing conclusions.	Knowing the purpose of the experiment; be able to choose, assemble and use physical instruments for experiments; be able to write the conditions and results of the experiment and draw a conclusion; development of research characteristics of students.
5.	Explain the principle of operation of physical devices	To be able to explain the operation and structure of instruments such as scales, dynamometer, barometer, simple mechanisms, hydraulic press, thermometer, psychrometer, internal combustion engine,

	and the structure of technical objects.	refrigerator, ammeter, voltmeter, microphone, glasses and to form their use in future life.
6.	Application of physical knowledge in practice.	Solving problems related to physical phenomena using learned concepts, rules, definitions, laws and formulas; to cultivate the qualities of using the knowledge and skills acquired in physics in everyday life, technology and life safety, in solving environmental problems (such as saving energy, saving heat in winter, using electric household appliances and being able to eliminate minor defects).

Competence, systematic, technological approaches form the methodological bases of development of different levels of competences in physics teachers. Such approaches imply the formation of the competence to use physical knowledge and tools in practice, the ability to apply the theoretical foundations of physics to everyday life and professional spheres, the acquisition of the skills of logical thinking and independent decision-making.

The development of educational competences at different levels comes through comprehensive knowledge, skills and competencies. The physics module has its place and importance in it. To develop these competencies, first of all, it is necessary to integrate them into the curriculum and programs of each module. Then, it is necessary to apply the basic competences created by the educational courses and modules in the creation of educational literature, including preparation for reprinting.

Professional competence does not mean the acquisition of separate knowledge and skills by a specialist, but the acquisition of integrative knowledge and actions in each independent direction. Also, competence requires constant enrichment of professional knowledge, learning new information, understanding important social requirements, finding new information, processing it and being able to use it in one's work [3].

Professional competence of a teacher means a set of professional and personal qualities necessary for successful pedagogical activity. A teacher who adequately implements pedagogical activity and communication, achieves consistently high results in teaching and educating students, can be called a professionally qualified teacher. The development of professional competence means the formation of creative individuality, the tendency to pedagogical innovations, and the ability to adapt to a changing pedagogical environment.

The professional competence of a physics teacher includes the system of scientific and theoretical knowledge, including special knowledge, professional skills, and experience in the field of physics, mathematics, and informatics. The main component of the process of developing the teacher's professional competence is subject competence; history and regional studies, socio-political, social and cultural competences allow any person, especially a teacher, to feel free and confident in this world; psychological-pedagogical competence - knowledge in the field of physiology, psychology and pedagogy; communicative competence - feeling comfortable in any society. All this becomes methodical competence. Methodological competence - includes methodical knowledge, professional and methodical skills (ability to formulate final and intermediate goals, plan, conduct and analyze lessons, establish and implement interdisciplinary connections).

Today, in the conditions of the information society, it is impossible to achieve the quality of education without using ICT in the process of physics education. In the conditions of rapid changes in information flows and used technologies, adaptation to the information society,

development of information and communication competence of a person is of particular importance.

The use of computers in education has led to the emergence of a new generation of ICTs, which can improve the quality of education, create new educational tools, and enable more effective communication with computers for teachers and students. The use of information technologies in teaching physics and increasing innovative activity are of urgent importance in the training of physics teachers [4].

From the point of view of the needs of teaching physics, the following promising directions of using new information technologies can be distinguished: modeling of physical phenomena and processes using information technologies; use of computer programs to effectively conduct lectures and seminars with virtual visual experiences. It is information technologies that allow to fully expand the concept of the educational process, to improve the methodology of lectures and practical training in physics at HEIs. Any physics teacher should be able to work with digital information, have an idea of the available software products, their purpose, and be able to use them when conducting a lesson or preparing for it.

At the current stage, the practice of teaching physics in HEIs is one of the urgent problems that require deep theoretical understanding. This is associated with a gradual decrease in students' interest in learning this subject, a decrease in academic results and general educational motivation. In this regard, the professional training of the teacher plays a key role, which is determined by the sufficient level of professional qualification of the specialist. It is natural to assume that the theoretical study of the teacher's professional competence should be based on practical pedagogy arising from higher education.

The professional competence of a physics teacher includes:

- **general subject competence**, which determines the level of ownership of modern pedagogical technologies. This is a physics teacher who has mastered the content sufficiently will have the ability to communicate effectively with students; the ability to acquire and improve skills in physics, taking into account the subsequent transfer of acquired practical experience to others. Science competence is aimed at the development of the necessary knowledge in this subject by the physics teacher. From this point of view, subject competence is closely related to methodical and pedagogical competences [5];

- **methodological competence**: based on the set of methodological knowledge, professional and methodological skills and competencies. This competence is manifested in the ability to formulate the goals and objectives of the lesson, to establish interdisciplinary relations between subjects, to determine the best forms of work for the effective transfer of knowledge in the subject [6];

- **the pedagogical competence** of a physics teacher is related to the ability to present the previously acquired theoretical and practical material to students in a convenient form. For example, a qualified physics teacher should have all the methods of knowing the environment - experience, observation and measurements. It is important to know the basic concepts and laws of physics as a science and to be able to apply them in practice. The teacher must understand the physical meaning of concepts and quantities, be able to analyze physical phenomena, laws and theories.

H.M. Inusov and N.A. Shaydenko consider information competence to be a component of the professional skills of a science teacher. A teacher who has mastered this competence creates a system of physical theories in accordance with the limits of their application [7].

For example, promising areas of information technology use for physics teachers include: modeling of physical phenomena and processes using computer technologies and applications; organization of lectures, seminars, practical work and virtual demonstration of experiments, taking into account the use of practical programs, computer programs [7].

M.N. According to Karpov, in turn, practical problems are revealed when solving practical problems: organizing experiments or laboratory work. Consequently, the teacher's professional competence is inextricably linked with the performance of theoretical and practical work [8].

One of the factors determining the quality of education is the content of the subject competencies of the teacher. This competence is one of the main components of the professional competence of a physics teacher and reflects the availability of the necessary professional knowledge. Professional knowledge includes, first of all, knowledge of the subject (in this case, physics) taught by the teacher to the students.

O.A. Dolgov stated that there are no basic competences in science, if a person has a complex of various competences, there is knowledge of science, skills and competences that can be effectively applied in practice. For example, competence with a physical subject - being able to explain the observed phenomenon on the basis of a known law of nature; Mathematical competence - readiness to perform calculations of a practical nature [9]. The components of professional-pedagogical competence of teachers of various academic subjects have a certain advantage, which is related to the specificity of the subject and the methodology of its teaching. The formation of subject competence smoothly turns into the development of the teacher's methodological competence.

G.A. Lopushnyan stated that the teacher's methodological competence includes methodological knowledge, professional skills (the ability to formulate final and intermediate goals, plan, conduct and analyze the lesson, establish and implement interdisciplinary relations with psychological-pedagogical and sciences) [10].

The first steps in the development of teacher competencies are "life skills" (personal problems, coping with stress; time management; reading instructions; drawing up business documents) and "skills above the subject" (being active, offering a non-standard solution, being able to reasonably defend one's point of view like). The development of the listed competencies in physics teachers is carried out both theoretically and in practice.

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