

The article is devoted to defining the essence of the concept of subject competence in physics. The article establishes universal and specific skills through which the subject competence is manifested in pupils, identifies cognitive, activity, emotional, methodological components and levels of formation of subject competence in students, as well as indicators for determining each of the levels. The article substantiates the importance of using Stem-tools, which include modern tools and technologies offered by technology, production and the digital world to develop the ability to study physics not only in the classroom, but also in the future professional field. The most used Stem-tools in teaching physics are identified and examples of their influence on the formation of each of the components of subject competence are given.

The rapid pace of scientific and technological progress necessitates the popularization of natural and mathematical education and training of specialists who would work in these fields. Unfortunately, the level of natural science literacy in Ukrainian adolescents, according to the final analysis of the results of international research in the field of natural sciences is quite low, due to low motivation to study natural sciences and mathematics and lack of skills to acquire knowledge independently in modern educational space.

Given the popularity and relevance of Stem-industries, it is important to develop the ability to study physics in the modern world of digital technology and scientific and technological progress. Therefore, the aim of the article is to investigate the formation of subject-subject competence and to develop a method of its formation by means of Stem-education.

On the basis of the analysis of researches of scientists and own considerations educational-subject competence we carry to group of competences "ability to learn". It is determined through universal skills, which include: reading comprehension; expression of own opinion; critical and systematic thinking; art; initiative; logical substantiation of the position; constructive emotion management; risk assessment; decision making; problem solving; cooperation with others and specific – the ability to work with different types of physical information and apply physical knowledge; ability to use physical information and transform it into various life situations; ability to solve different types of physical

problems; ability to create own physical tasks; ability to present information with the help of graphs, formulas, schematic drawings; ability to read graphs, tables, diagrams. ability to conduct observations, experiments, research, use measuring instruments, models, make electrical circuits; ability to create a task; design, inventive, research skills, which are formulated by means of the subject. The structure of educational and subject competence can be represented through cognitive, activity, emotional, methodological components.

The cognitive component includes: a set of methods, tools and techniques for optimizing the processes of obtaining, storing and using the necessary knowledge of mankind in the information environment, based on intellectual activity (structuring, analysis, synthesis, selection, etc.) and aimed at forming a research style; knowledge and understanding of technologies for the development of perception, attention, memory, thinking.

Activity component: includes the ability to use methods of learning in practice; use of memorization methods; use of concentration methods; use of methods of activation of thinking; use of ways to check the formation of thinking; use of information and communication tools and platforms in solving problems, performing experiments (real and virtual), performing calculations; ability to learn virtually and realistically; ability to engage in project activities.

Value component: includes understanding oneself as a person and one's individual characteristics that help in learning and the ability to use them; ability to control their emotions.

Methodological component: ability to design own development trajectory; the ability to choose the right tool for learning from the list of known; ability to plan one's own learning; ability to use control and self-control technologies to track and understand one's own progress.

An objective necessity in the high-tech and digital age is the use of Steam tools in the educational process of natural and technical disciplines, which is physics, in particular. Stem-tools used in physics lessons include: visualization tools, constructors, simulations of physical phenomena, video laboratory work; mobile applications; mental maps, reference notes; technological patterns, analogies, 3d-models designed, analogies, online and offline

hubs. The use of Steam-tools contributes to the formation of all components of subject competence.

Depending on the degree of manifestation of certain personal indicators and skills, we can distinguish four levels of formation of educational and subject competence are: low – the pupil learns only with the help of the teacher; middle - the pupil knows about methods and technologies, heard about them in lessons, but does not apply; sufficient – the pupil is able to use the methods of memorization, methods of activating thinking offered by the teacher, techniques for better memorization, activation of memory, thinking, which usually facilitate the process of mastering complex disciplines; high – the pupil knows, knows how to use, knows how to choose the most optimal ways to learn, remember, train thinking, knows how to control emotions in case of failure, choose a new method of learning, evaluate effectiveness and is not afraid to switch to another; searches for effective ways to study physics; transfers effective ways of studying other subjects to the study of physics; interested in studying physics.

Thus, today it is important to form the ability to study the subject with modern means and technologies, not detached from life, because we live in a time that requires continuous improvement of their skills and abilities. The teacher's work on the formation of the concept of understanding how to study the subject will contribute to the formation of subject competence. The formation of subject competence in pupils today is effective when children are interested in learning. Therefore, the use of Stem-technologies for the formation of subject competence forms the competence of mental activity, provides acquaintance with innovative tools and their use in the educational process for the study and research of physics, and methodological competence, which is to understand how to effectively study physics. Prospects for future research are related to the description of the methods of existing effective Stem-tools for studying physics in school.