

## **METHODOLOGY OF DISCUSSION OF FUNDAMENTAL FEATURES OF ELEMENTARY PARTICLES IN PEDAGOGICAL EDUCATIONAL INSTITUTIONS**

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### **ABSTRACT**

This article discusses the ways in which the formulation of ideas about the fundamental properties of elementary particles is considered in higher education lectures.

**Keywords:** elementary particle, strange, charming, isotopic space, interaction, classification, methodology, higher education, pedagogy, lecture, pedagogical technology, innovative method.

The development of society requires the training of mature and high-level thinking personnel in accordance with the world standards. This requires raising the teaching to a higher level, both in terms of content and style. In this regard, there is a need to conduct scientific and methodical research, including creating a new generation of programs and textbooks, writing training manuals. Based on this necessity, in a short time, educational programs, textbooks, manuals for various stages of the physics education system were developed, and this process continues.

We know that the main purpose of teaching physics is, firstly, to explain the fundamental laws of nature on a scientific basis, to develop students' scientific worldview and philosophical reasoning abilities, to form ideas about physical processes that explain the principle of operation of equipment and tools used in technology and life, and secondly, to continue education. , is to deepen the acquired knowledge and create a solid foundation for continuing scientific research. Today, one of the developing fields of physics is particle physics. Full disclosure of the content of particle physics during the lesson requires high skills and knowledge from the teacher.

is distinguished by the complexity of the processes it studies, requiring deep observation and imagination . For this reason, the issue of humanization of this field is in the first place. That is, to organize the teaching of this department at a level that students understand and ultimately achieve high efficiency. For this, it is important to describe each topic in comparison with topics in other branches of physics. Otherwise, the terms, concepts, and measurement units used in particle physics seem abstract , insignificant, and meaningless to students . For this reason, it is important to emphasize the need for a unique approach in conveying the topics of elementary particle physics to students. Observations in the course of training show that it is effective only if it consists in explaining the purpose of each topic, clarifying its reason, ensuring that the terms, units of measurement and concepts used in the topic reach deep into

the minds of students. For this reason, it is good to dwell on the measurement concepts and units used in particle physics separately and, if necessary, within each topic, to explain them in connection with the general measurement units and concepts [1].

When describing topics related to quantum numbers, it is important to achieve a complete statement of the reasons for the introduction of these quantum numbers. For example, the independence of nuclear forces from the electric charge of interacting particles was explained on the basis of the introduction of the concept of "isotopic space", the first internal, hidden space, into science. Similar strange and fascinating particle properties have led to the introduction of "strange" and "fascinating" interspaces and their corresponding quantum numbers[2]. In the current state of development of particle physics, we have 11-dimensional space. Therefore, a clearer explanation of the nature of these quantum numbers was made based on a new approach to the concept of "symmetry". This new interpretation allows students to fully grasp the fundamental properties of particles.

For many years, the traditional education, which took a priority place in the practice of pedagogy, meant the gross reading of students and the organization of their cognitive activity as a passive listener.

In our current educational system, the main focus of the learning process is on the learner and he acts as an object in the learning process. The teacher should focus on the needs of the learner. This is exactly the approach that comes in handy when teaching particle physics. This approach corresponds to the nature of particle physics, i.e., the need for complex imaginations, the need for a lot of creative work to understand the processes. Therefore, it is necessary to manage the lessons according to the essence of the topics reaching the students [3].

Education and training of students the use of modern pedagogical technologies is the demand of the times. From this point of view, it is appropriate to determine the methods of modern pedagogical technologies that are highly effective for the department of particle physics. Accordingly, it was found that the use of new pedagogical technologies such as cluster, Venn diagram, T-table, SWOT-analysis, BBB during lectures, seminars and practical sessions is highly effective. At the same time, it was found that it is possible to achieve good results in strengthening the topics through debate, discussion, and communication methods.

The next step is to organize lectures, seminars and practical training aimed at activating the cognitive activity of students, increasing the effectiveness of education in the teaching of elementary particle physics department. In order to improve the teaching efficiency of this department, a training system is developed based on the types of training, teaching methods and tools based on the nature of the subject, the knowledge and skills of the teacher. A system of training is understood as a series of trainings that are interconnected in content. Educational methods can be effectively used when organizing classes in the form of lectures. The lecture itself is both a method and a form of the educational process, and serves to teach students the basics of science, and is effective when organized on the basis of a creative approach [4]. Three types of lectures from the point of view of the elementary particle physics department; introductory lectures, thematic lectures and summary lectures are effective. The introductory lecture is used at the beginning of the department, and in it, students are given comprehensive information about the subject of the department, its place, goals and tasks, and its relationship with other departments. In the thematic lectures, each topic is covered in detail. Summative

lectures can be used before mid-term or final control or at the end of the unit. Taking into account the above, the lecture sessions were developed as follows .

The lecture session will have the following structure:

Lecture topic: Fundamental properties of elementary particles.

The educational purpose of the lecture: To acquaint students with the fundamental properties of elementary particles, their participation in fundamental effects and their classification.

The educational purpose of the report: to expand the scientific worldview of students and increase their interest in this subject by explaining the theoretical and practical importance of the elementary particle physics department.

The developmental purpose of the report: To develop the knowledge, concepts, and skills of working on the textbooks of the students in the department of elementary particle physics.

Lecture equipment: fundamental properties of elementary particles, tables with elementary particles and their characteristics, slides with particle accelerators, animations, internet materials.

Technology used in the lecture: Modified lecture, demonstration and conversation methods are supported.

of the lecture :

- I. Organizational part.
- II. Introducing students to the topic, purpose and plan of the lecture .
- III. Expanding and deepening the knowledge and ideas of students in general education schools, academic lyceums and vocational colleges in the department of elementary particle physics.
- IV. The report is the subject of the statement.

Mode:

1. Types of interactions
2. Fundamental properties of elementary particles
3. Problems of elementary particle physics .

In planning this lecture, it is necessary to take into account the knowledge and ideas of students from the program of previous stages of education. For this reason, before presenting this lecture, a conversation with students is organized within the topic, their basic knowledge is determined, and then a new topic is presented. For this, students are given the following questions as examples:

1. What types of effects are there in nature?
2. What classes are elementary particles divided into?
3. What types of interactions exist between particles?
4. What kind of particles are baryons?
5. What kind of particles are leptons?
6. What do you know about multiple interactions?
7. What do you know about weak interactions?
8. What do you know about electromagnetic interactions?
9. What do you know about gravitational interactions?

The main function of this process is to motivate: with the help of the given questions, with a clear goal in mind, the students are able to recall the knowledge they have and to be able to express and discuss them among themselves.

After the question and answer, the teacher explains the new topic based on the plan with the help of visual materials (tables, electronic posters - slides).

Test questions are created to check students' knowledge of the topics presented in the lectures. If the test is created in MyTest or iSpring, not only the teacher, but also the student will be able to evaluate himself.

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