SOME ACTUAL ISSUES OF TEACHING MODERN PHYSICS IN HIGHER EDUCATION

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ABSTRACT
The article discusses some current issues of modern physics, the role of the education system in solving problems, new approaches and effectiveness of educational processes in higher education institutions which can be widely used by professionals specializing in the theory of education and upbringing.

Keywords:
education system, pedagogy, higher education, physics problems, engineering, science, modern requirements, teaching, vocational, vocational education, specialist, reform, pedagogical staff, research, equipment, training, classical physics, natural sciences.
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Introduction

The main goal of the ongoing reforms in the field of education and upbringing in the world is to form a generation who are healthy and well-rounded, educated with high spiritual and moral qualities. To achieve this goal, the "National Model" of training mature professionals living in a new era, new thinking, new production, operating in new social conditions, rich in modern professional knowledge and skills is being implemented. It is important that the system of training, education and upbringing of specialists is closely linked with the requirements of the reforms. One of the most actual issues which we are facing is the training of qualified teachers who can meet the requirements of the times, the improvement of education and all its components in accordance with the requirements of state standards of higher education. From this point of view, the block of disciplines taught in higher education in accordance with the curricula in the areas of training and specialties, its structure, content, quality and effectiveness of teaching are highlighted. It should be noted that along with the teaching of humanities and natural sciences, general professional, additional and specialized subjects, special attention is paid to the teaching of special (elective) subjects. In this article, we discuss the course "Physics" which should be taught as an elective subject for bachelors, masters and students of retraining and advanced training. Some current issues of teaching the basics of modern physics are analyzed, along with theoretical solutions and specialties (courses), such as the meaning of the term - what is its essence or how it differs from "classical" physics.

Materials and Methods

First of all, we define the meaning and essence of the term "modern physics" and how we understand it. When thinking about this term, one should not understand "modern", "new" or "nonclassical" (in most sources "modern") and "old" or "classical", "classical" in the sense of contrasting, comparing or relating physics. As both the "most modern" physics and classical physics are general sciences of nature; they study the structure, shape, properties of matter, and the

general properties of its movements and interactions. These features are common to all material systems. Some natural sciences, such as chemistry, geology, and biology, study the special laws governing the complex interaction of forms of matter in different and definite material systems. Consequently, there is a connection between physics and other natural sciences. Physics is the theoretical basis of technology. The development of human society, the socio-economic and other conditions of historical periods play a certain role in the development of physics. Depending on the forms of motion of the objects and materials studied, physics consists of closely related sections of elementary particle physics, nuclear physics, atomic and molecular physics, gas and liquid physics, solid state physics, and plasma physics. Depending on the processes studied and the forms of motion of matter, physics includes material point and solid body mechanics, thermodynamics and statistical physics, electrodynamics, quantum mechanics, and quantum field theory. The discovery of the law of conservation and circulation of energy, which binds all the phenomena of nature as a whole and in natural science, including the development of physics.

Classical physics deals with matter, space, time, mass, energy, and so on. It consists of specific notions, concepts, laws and principles and is divided into classical mechanics, classical statistics, classical thermodynamics, classical electrodynamics and other sections.

The division of physics into classical and nonclassical physics is conditional. Galileo-Newtonian mechanics, Faraday-Maxwell electrodynamics, Boltzmann-Gibbs statistics are generally incorporated into classical physics, field quantum theory and relativity theory into modern physics. Historically, this is indeed the case. However it is unreasonable to contrast classical physics with modern physics. Significant progress has been made in the use of classical physics in areas such as new techniques, technologies and space exploration.

Physics makes extensive use of other disciplines, including mathematics, in the quantitative analysis of the phenomena it examines. Depending on the course of events and the complexity of their nature, the mathematical methods used are also complicated. At the present time it is impossible to be limited to elementary mathematics, differential, integral calculus, analytical geometry, simple differential equations. For example, concepts such as tensors and operators are widely used in field theory. The development of physics has always been closely linked with other natural sciences. The development of physics has led to the development of other natural sciences and in many cases the emergence of new sciences. For example, the invention of the microscope by physicists led to the widespread development of chemistry, biology, and zoology. The creation of the telescope, the discovery of the laws of spectral analysis accelerated the development of astronomy. The discovery of the phenomenon of electromagnetic induction and the invention of radio led to the emergence of the sciences of electronics, radio electronics and radio engineering. There are so many fields that physics is studied along with other sciences. Thus came the chemical physics, biophysics, astrophysics, geophysics and other sciences. The discoveries made in physics led to the development of various fields of technology and, ultimately, to the rapid development of industry and the national economy.

In turn, the achievements of the technical sciences led to the further development of physics. In the development of technology, in the national economy as a whole, we had to solve the physical problems that arose continuously. This requires that the technical sciences always work in conjunction with physics. Significant achievements have been made in Uzbekistan in the fields of nuclear physics, physical electronics, solid state physics, high energy and cosmic ray physics, semiconductor physics, photonics, acousto-optics, acoustoelectronics, laser physics, heliophysics, heliotechnics and other physics [1,2

encyclopedia]. Thus, there is no antagonistic contradiction between "modern physics", "new physics" or "nonclassical physics" and "classical physics" or "classical physics", as in the development of the primordial to a new stage, the object must be evaluated only in terms of qualitative criteria. But not only in physics, but also in other natural and exact sciences, when the beginning is seen as a superstructure, the building is built on it. Such an approach to "modern physics" is important for future conclusions. When physics is considered as a holistic science, the existing physical directions, its components, related parts, combined fields of two sciences (astrophysics, physical chemistry, mathematical physics, etc.) and the structure and scope of research are extremely diverse (quantitative classification) the assessment is meaningless). But it is dominated by the principles of integrity, interdependence, general development (laws of physics, proven theories). There is no doubt that in the development of mankind, every science develops and enters a new stage, and it serves the development of human society. Consequently, on the basis of "modern physics", humanity is on the verge of discovering new revolutionary innovations and discoveries in the 21st century. Undoubtedly, it is achieved due to strong theoretical training and methods, scientific potential, modern research technologies, advanced scientific techniques in research, the use of equipment. Such innovations in science can be introduced only in a very small part, as the possibilities of curricula and programs within the framework of general secondary or higher education standards are very limited. On the other hand, in fact, when it comes to physics, it must be acknowledged that today's students study the physical phenomena, processes, and theories discovered in the 1950s and 1980s, only the universal physical discoveries and discoveries made on its basis. it is only after the introduction of new technology or techniques into everyday life that they understand what a physical phenomenon or process is, its “physics”. For example, laser physics has also been introduced into higher education programs as a result of changes in daily life, technique, and technology, many such examples can be cited. From the point of view of a university student, "Physics" is considered as a separate, whole, integral, rigid science, system (in terms of learning and mastering). Thus, the accumulated knowledge in the field of science, practice, technology and research is left out of the eyes of students, teachers and educators who are "responsible" for their acquisition, they study physics only within the standard requirements and there are objective and subjective reasons. should not be underestimated, for example, the size of study hours, their limitations, etc. It can be seen that the scale of the development or research base of modern physics is to some extent ahead of the scale of its teaching.

At the current stage of development of "Physics" as a science, the gap between scientific and pedagogical views on physics is growing. In our view, the main reason for this is the lack of a methodology for teaching students the basics of modern physics. In addition, the network of study hours for higher education institutions includes "Fundamentals of Modern Physics" (this subject can be called differently, for example, "Current trends in modern physics", "Achievements of modern physics" or "Modern physics in general", etc.) It is necessary to allocate teaching hours for the subject, to develop methodological manuals for the educational process, to address the issues of teacher training.

The main purpose of teaching the basics of modern physics in higher education is to provide students with knowledge of various theories, laws and principles in accordance with the requirements of state educational standards, as well as new areas, new directions, achievements in "modern physics". It is also important to impart knowledge about new discoveries, their development, new scientific discoveries made, the importance of technical and technological developments for humanity. Before we cite the

latest scientific discoveries and advances made in modern physics on the subject, let us consider an important issue. Nowadays, there are many sources of information for students or teachers of retraining and advanced training courses. These are primary or secondary sources in the form of text, graphics, sound, digital information, video information and they include:

1. Nature and the being that surrounds us;
2. Educational, scientific and other libraries;
3. Internet (virtual) global information system and its components;
4. Television;
5. Radio;
6. Various courses, clubs;
7. Different societies, certain professionals (e.g. pedagogue).

By analyzing the sources of information, we can determine how reliable or false it is, whether it is true or not and other qualities. There are certain procedures for obtaining information. First and foremost, a culture of information must be followed. The purpose of quoting the above sources is to get acquainted with the prestige and potential of the source of information, the audience of its users before getting acquainted with the cosmic new discoveries in modern physics, newly developed theories, current trends in modern physics. This is as some sources of information (especially on the Internet) contain false, misleading, sensational or “ordered” information to intimidate, panic and other purposes. For example, there is a lot of information in the "global information ocean" about the "apocalypse" or "apocalypse", especially in recent times, to exaggerate some physical phenomena of nature, to mislead people, to draw unscientific conclusions, to spread unscientific theories. As our opportunities to cover these issues more broadly are limited, we emphasize that we need to focus on the main issue, that is, to get real original information from accurate, reliable sources.

We now turn to the latest scientific discoveries and advances in modern physics on the subject. They are:

-field theory of elementary particles;

-elevation of the gravitational field of elementary particles, new discoveries on Higgs bosons;

- The electromagnetic nature of the kinetic energy of all particles;

-electron neutrinos or electronic antineutrino annihilation reaction;

-in biophysics, the aging of the human body or the breakdown of the cardiovascular system due to structural changes in blood plasma;

- The problem of global warming;

-quantum teleportation;

- Experimental evidence of the presence of graphene and quark gluon plasma;

-research on elementary particles in a large hadron collider;

- advanced experience in teaching modern physics, etc.

Results and Discussions

Now, we look at the scientific discoveries and achievements of modern physics and humanity in general over the past 10 years:

- The first synthetic “life” - several synthetic microbes were artificially created in 2010 (consisting of 473 genes, the J. Craig Venter Institute Institute collected the bacterial genome of Mycoplasma mycoides);
- A new drug for the treatment of AIDS is developed (The New England Journal of Medicine in 2011 The drug reduces the incidence of AIDS by 93%);
- The Higgs boson was discovered in the Large Hadron Collider, the largest particle accelerator on Earth in 2012. The fact that this particle has mass is compared to the Higgs energy field.
- After nearly 35 years of flight - the American Voyager - 1 automatic space station left the solar system in 2013. Prior to that, he spent 10 years transmitting information to Earth about a number of planets - Jupiter, Saturn, Uranus, Neptune. This device will deliver the data it received

to us by 2025, after which it will remain in the depths of the universe. For the aliens, it houses a gold plate and a special capsule that contains images depicting people, the solar system, and human civilization.

- The existence of gravitational waves was confirmed by scientists in 2014. Scientists have been able to detect the "rise" and expansion of space and time that occurs in a few thousandths of a second after the Big Bang, a change in the polarization of relic radiation, which is called "V-mode". V-fads were recorded in Antarctica using the BICEP 2 telescope. Due to gravitational waves, many other information about the dynamics of the collisions of "black holes" and neutron stars and the evolution of the universe are being obtained.
- The first CRISPR editing was performed on the human embryo in 2015. Genetic diseases in humans can be prevented using this method. Scientists at Sun Yat-sen University in China were the first to genomodify the human embryo. Currently, there is a debate about the ethical norms of this direction.
- An exoplanet (Proxima b) was discovered in the regions of the universe where life exists 4.2 light-years away from us in 2016.
- A very ancient eruption delayed the age of Homo sapiens by 100,000 years, leaving its age on the planet at 300,000 years in 2017. Scientists have determined that the rocks found in one of the caves in Morocco in northern Africa are 300,000 years old.
- Sister babies were born based on CRISPR editing in the human embryo in 2018.
- For the first time, a photo was taken around the "black hole" in 2019. It is known that there are "black holes", the fact is that light can not overcome their gravity, so we can not see them. The star pictured is at the center of the Messier 87 galaxy, whose diameter can be compared to the diameter of the solar system.
- The 2020 (October) Nobel Prize was awarded to three scientists who have studied "black holes" in astrophysics - Roger Penrose, Reinhard Gentsel and Andrea Gez.

Physicists have achieved extreme permeability at room temperature, Russian and British physicists have determined the maximum value of the speed of sound.

Such discoveries and achievements in the field of physics can be cited in many examples.

The study and analysis of the existing scientific and educational, methodological literature in the field of pedagogy shows that it is necessary to develop current trends, achievements and teaching methods of modern physics and introduce it in general and secondary special, vocational and higher education systems. In higher education, in particular in higher education institutions in the field of pedagogy, it is necessary to introduce the subject "Fundamentals of Modern Physics" as a separate module and perform the following tasks in its teaching:

Inclusion of teaching hours on this subject (module, course) in the curricula and programs of pedagogical higher education institutions;

1. Development of forms and methods of teaching it;

2. Development of theoretical criteria for the selection of current trends and issues of teaching modern physics in higher education;

3. To define this subject as a main subject (component) in the curriculum in teaching students the basics of modern physics;

4. Introduce special courses for future teachers in the field of "Physics" in teaching the basics of modern physics, for example, "Physics on the threshold of the third millennium."

5. Development of a special course methodology on modern physics in pedagogical higher education.

6. Other disciplines of "Modern Physics", in particular, "Advanced foreign experience in

teaching physics", "Computer modeling of physical processes", "Development of scientific and innovative activities", "Introduction of digital technologies in the educational process" and other training modules, they development of methodological manuals on integration, etc.

The introduction of a special course "Physics on the threshold of the third millennium" in teaching future teachers of "Physics" in the basics of modern physics will expand their opportunities to learn modern physics at the micro, macro and mega levels. It is necessary to develop and approve illustrative materials for lectures.

So how are they selected? The selection of "important, interesting and relevant" areas of modern physics can be based on the following criteria:

-First, the level of importance of the field of physical research for humanity (for example, the field of application of controlled fusion as a source of energy);

-Secondly, the importance of the direction of physical research in terms of fundamental importance (for example, elementary particle physics);

- Third, the question of the existence and place of mankind in the universe (for example, astrophysics, mega-universe physics, threats to humanity, space, natural disasters);

-Fourth, the two-way inseparable connection of physics and technology (the above and many other examples can be cited);

-Fifth, the importance of a particular field of modern physics for the educational process (for general secondary and higher education).

The introduction of a special course for teachers of higher education and high school students "Physics on the threshold of the third millennium" can also be effective in mastering the basics of "modern physics" To teach students or listeners with the basics of modern physics:

- ✓ selection and presentation of its main directions, concepts, laws and theories; shaping new facets of the natural scientific landscape of the world that surrounds us in their minds; updating of basic natural scientific research methods;
- ✓ enriching students' memories in the process of studying the material, as well as developing their creative abilities;
- ✓ enriching students' scientific outlook; educating students in the process of teaching the basics of modern physics: the implementation of ideological-political, military-patriotic, international, moral and labor education;
- ✓ to enrich the imparting of basic knowledge to students, to prepare them for socially useful work and to consciously enrich their professional knowledge.

None of these can be solved by separating them from each other. All of them are implemented in a complex way in the process of joint training. Through the consolidation of knowledge, the student's thinking develops, the scientific worldview expands.

Teaching in the enrichment of worldview, the possibility of knowing the world in the minds of students in the process of education and the dialectical nature of the process of learning; the material unity of the world, the inseparability of matter and motion; interconnectedness of natural phenomena; the inexhaustibility of the properties of the material world, the infinite process of cognition. This means shaping their worldview correctly.

It is necessary to organize pedagogical (didactic) activity on the basis of the principle of simple to complex teaching of science. For example, in addition to studying the structure of matter from atoms and molecules, the second view of matter also introduces the concept of field.

Throughout the course, it should be shown that matter is manifested in two interconnected forms, namely matter and field. Consideration of

the general properties of matter and space is important in the correct formation of ideas about the material unity of the world in the minds of students.

1. The concepts of mass, energy, momentum, spin, as well as "matter" characterize the "field" particles.

2. Corpuscular-wave dualism applies to both matter particles and field particles; the unity of corpuscular and wave properties is an important characteristic of all elementary particles.

3. Just as matter particles become field particles, field particles also become particles of matter.

4. Particles of both appearances can be both stable and short-lived.

Students' attention should be focused on the fact that particles of matter use the field to form various structural systems (atoms, molecules, macrostructures, etc.). The structure of matter cannot be imagined without space. The particles interact through the mutual field.

By teaching the movements of nature and being through the use of various animated programs in the learning process, it leads students to understand that movement is an integral property of matter.

First, there is mechanical motion, molecular motion and electron motion. In the study of the phenomenon of electromagnetic induction, it is necessary to draw attention to the relationship between mechanical motion (movement of a conductor in a magnetic field) and the motion of electrons and the formation of an electromagnetic field. It discusses the achievements of modern physics, such as the experimental proofs for the existence of graphene and quark gluon plasma.

Another direction is that the loss of motion is reflected in the law of conservation and circulation of energy. Starting with the basic concepts of energy, the concepts of electrical phenomena, motion, and the corresponding energy cycle are considered. Thus, it is necessary to pay attention to the transition of motion / energy / to new appearances, and it would be expedient if, for example, knowledge of the electromagnetic nature of the kinetic energy of being particles or electronic neutrinos or electronic antineutrino annihilation reaction is given.

Conclusion

In the process of teaching modern physics, students are explained the interdependence of phenomena, their causes and laws of development (consequences).

In order for students to have a clear idea of the connections between events, their attention should be focused on finding important connections between events. In this case, it is useful to show connections not only with physical phenomena, but also with other phenomena (biological, chemical, cosmological, etc. ...). For example: improving the electric field / cause / plant development or adverse effect / consequence /.

It is recommended to consider the following areas of technical progress in the teaching of modern physics in higher education:

- production automation;
- production of new, nanomaterials and advanced technologies, their improvement;
- use of alternative energy sources and energy;
- New equipment and technologies created using alternative energy sources, electrification;
- Radio and quantum electronics, techniques and technologies based on the basics of nanophysics, a new generation of electronic computing;
- New optical techniques and technologies;
- application of new technologies in production, etc.

The organization of work in this area requires the solution of a number of practical problems, in particular, the formation of educational, methodological (methodological), pedagogical potential and professional skills. It should be noted that some progress has been made in solving these practical problems, for example, a number of scientific researches conducted at the Russian Academy of Pedagogical Sciences, the Academy of Sciences of Uzbekistan, the National University

of Uzbekistan named after Mirzo Ulugbek, Bukhara State University and other pedagogical research centers. The results were announced. These results will allow in the near future to carefully develop the current trends, achievements and teaching methods of the development of modern physics and its mandatory introduction in general secondary, secondary special, vocational and higher education systems.

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