International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Developing Practical Skills in Physics Students at Technical Universities

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DOI: https://doi.org/10.55248/gengpi.5.0524.1354

ABSTRACT.

This article proposes a methodology for teaching physics that integrates information and communication technologies as a bridging element between teachers and students. Modern technologies are utilized for their capabilities as primary information sources, for modeling specific phenomena and experiments that cannot be conducted in their natural form, and for enhancing the educational process's information richness and intensity. These technologies also employ unique programs to activate the learning process in physics.

Keywords: innovative technologies, physics, practical skills, students.

Introduction.

Nowadays, the rapid development of innovative technologies in the higher education system gives rise to the problem of revising teaching tools and methods. After all, not only the duration of training is changing, but also a new educational paradigm is being introduced, built on the widespread informatization of the educational process.

Among the numerous tasks facing a physics teacher in the new conditions is the formation of practical skills in physics among students of technical universities. Solving this problem will ensure the effectiveness of physical education of students and prepare them for active productive activity.

Among the specific skills and abilities of students, we can highlight the iconic ones, which are most characteristic of physics as a science and an academic subject, serving to develop practical skills in other subjects of the natural cycle of disciplines of the curriculum in universities [1-4]. In particular, it is the ability to conduct scientific observation, the ability to conduct a physical experiment and the ability to evaluate measurement errors.

Effective form of skill development.

An effective form of organizing the process of developing practical skills in physics is frontal laboratory work. In the process of performing laboratory work and experiments, students become convinced of the objectivity of physical laws, gain direct knowledge of the methods used in scientific research, become familiar with physical measurements and ways to quantify physical phenomena, and acquire practical skills provided by the program [5-7].

Repetition of educational material contributes to a deeper understanding, consolidation in memory and improvement of practical skills.

However, the implementation of the positive features and qualities of concentrism is possible only by taking into account certain psychological effects generated by repeated study of the same material. First of all, the relevance of the material being studied is lost. This applies to both the theoretical and practical components of the content of the program material.

Any repetition is a movement forward; it should always contain an element of novelty. A new formulation of the problem, a new regrouping of the material, new exercises and tasks, a new experiment, the introduction of new data from science and technology, and all this attracts the attention and interest of students, excites their activity and thereby ensures good repetition of the material.

The current program provides for the study of the fundamentals of physics at the academic and specialized level. It solves didactic problems, and in general, students acquire the skills of measuring force using the static method.

Force is one of the fundamental concepts of classical Newtonian dynamics, so the decision of the program compilers is quite understandable: with such a number of frontal laboratory works, the ability to make measurements is successfully developed, the theoretical material studied is repeated, and a system of knowledge completed at a certain level is formed.

At the same time, the problem of effective implementation in practice of the didactic possibilities of the ideas of concentrism arises.

Provided that the discipline "Physics" is taught at the highest level, the use of modern theoretical, experimental and technical-technological material [8-10] is required. It is clear that the content of laboratory work on developing measurement skills should be significantly complicated, filled with new actions and methods of measuring force.

Since the essence of this provision is that cyclicality and repetition in the process of developing practical skills must be accompanied by deepening the content and methods of teaching, we consider it necessary to introduce the concept of the principle of extended continuity. This principle should regulate the content and structure of educational material if there is a need to re-study it.

Among the elements of physical speech, the determining position is occupied by the physical concept with its corresponding physical quantities and terms. Adequate use of physical terms and their symbolic representation in accordance with the essence of the concepts that they reflect guarantees the proper depth of knowledge, skills and abilities of students in physics. Physical quantities also occupy a key position in the process of formation, generalization and systematization of knowledge. Reflecting the content of a physical concept, a physical quantity translates the characteristics to which the concept relates into quantitative form; this is a property that is common in a qualitative sense for many objects, systems, states, processes and individual in a quantitative sense for each of them. Individuality is understood as a property inherent in one individual object. It can be a certain number of times greater or less than a similar property of another object.

Only the use of physical quantities made it possible to translate physics into the language of laws and patterns expressed in mathematical form. Expressing the genetic relationship of physics and mathematics, physical quantities require clarity in definitions and scientific content, which in practice is realized through the proper scientific interpretation of physical phenomena, laws, theories, reflection of directions of development and new achievements of science, according to the established views of science on the basis of established norms modern physical language. Specific and generic differences between physical concepts and quantities are reflected in the system of corresponding terms. An essential component of the educational process in physics is familiarizing students with physical terminology and developing the ability to use it. Not only teachers are responsible for this, but also all teaching aids - textbooks, multimedia, printed manuals, popular science literature. Only the correct use of scientific terms in teaching guarantees the opportunity to give students deep scientific knowledge and form their scientific worldview.

The decisive role in the formation of scientific terminology - the basis of physical language - belongs to metrological services, which work to clarify the definitions of terms, determine the scope of their application, and the rules of use. This process is connected with the development of science and is clearly dialectical. The development of science, clarification and detailing of scientific knowledge encourage changes in terms. And sometimes until it disappears completely. An example is such terms that were widespread in the past as "magnetic masses", "universal ether" and etc. These terms disappeared from use in science, ceased to function in physical language and became the property of history. Some terms have acquired meanings that are not characteristic of their stylistic content - amount of heat, current strength, aperture ratio, capacity and etc.

Table. Specific characters physical quantities

Physical quantity	**Length**	**Circle radius**	**Circle diameter**	**Height**	**Length waves**
Dimension	[L]	[L]	[L]	[L]	[L]
Designation	*l*	R	D	h	λ
Standard	l={ *l* } [m]	R={ *l* } [m]	D={ *l* } [m]	H={ *l* } [m]	λ={ *l* } [m]

Results.

In physics, there are a number of physical quantities that also have the dimension of length, but relate to different physical phenomena, and then have separate specific symbols. A comparison of these values is given in the above table.

Consequently, if, according to standards, we are guided by the designation of length through l, then all listed quantities should simply be the length l, regardless of the phenomena or properties in which they manifest themselves. After all, they all have the same size. Standardization of the designated physical quantities is a necessary condition for ensuring the required quality and level of communications. Standardization simplifies reading scientific literature and leaves inappropriateness in solving problems.

Conclusion.

The research conducted on developing practical skills in physics students at technical universities demonstrates the pivotal role that hands-on, experiential learning plays in enhancing students' understanding and application of theoretical concepts. By integrating structured laboratory sessions, simulation tools, project-based learning, and industry collaborations, technical universities can significantly improve students' laboratory skills, engagement, and readiness for professional environments.

Key findings from this study include a notable improvement in students' ability to perform scientific observations, conduct experiments, and analyze measurement errors.

The strategic focus on developing practical skills in physics education is essential for producing competent and confident graduates who are well-equipped to meet the demands of the engineering and technology sectors. Continued innovation and investment in practical training resources, coupled with professional development for instructors, will further strengthen the quality of physics education at technical universities. This approach not only enhances students' academic performance but also their readiness to contribute meaningfully to scientific and technological advancements.

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