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METHODOLOGICAL MODEL OF DIFFERENTIAL EDUCATION IN TEACHING PHYSICS

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Abstract:

This article outlines the methodological system of differential education in physics for undergraduate students of technical disciplines, the construction of nonlinear learning trajectories. Methodological model of construction of nonlinear learning trajectories in the project activities of education on the basis of a differential approach to future engineers provides the principles of development of general professional and general cultural competencies in its implementation.

Keywords: Paradigm, didactic principle, synergetic principle, methodology, concept, nonlinear learning trajectories, differential education, innovative education.

Empirical organization of the process of teaching physics in technical higher education institutions in the process of observation and analysis; goal setting, higher engineering education, which plays the role of certain standards of higher education in physics: the need to develop new approaches to education; physics; to implement the design of training for future engineers and professional activities.

The theoretical foundations of the concept include:

- methodological approaches: systematic, competent, active;
- concepts (basic): professional competence, engineering competence, fundamentalism, "general physics";
- didactic theory of the subject;
- didactic principles (scientific, systematic, interdisciplinary, comprehensibility, relevance of theory to practice, individualization and differentiation, fundamental, career-oriented) [1].

The core of the concept consists of a system of rules that express the essence of the concept and a methodological model of differentiated teaching of general physics to students of technical universities.

The methodological model is developed in accordance with the scientific and theoretical basis and the content model of the general physics course and its individual sections, as well as the concept of technologies for teaching general physics to students [2].

The main provisions of the concept include:

- Differential training of future engineers in general physics should focus on the formation of professional competencies.
- The professional competence of the future engineer includes special competencies: subject, ideological, methodical and information-mathematical, among them the competencies on the choice of content and methods of studying different branches of science and the organization of educational activities in physics.
- Necessary conditions for the formation of professional competence in future engineers:
  - explain the essence of physics;
  - The formation of the relationship between the principles of fundamental and professional orientation in the development and implementation of a methodological model of teaching general physics;
  - Ensuring the integration of the content of the general physics course with general and specialized disciplines.
- Introduce a process block consisting of the basic laws of the subject "General Physics", theoretical and practical forms of activity, teaching methods and organizational forms of teaching.
- A prerequisite for the implementation of the principle of fundamental teaching in physics for future engineers is the selection of topics for the general physics course and its formulation in accordance with the content of fundamental physics.
- The leading form of knowledge should be physical theory in its modern interpretation. The content of the physics course should be the basis for the development of the student's theoretical thinking and his professional development.

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- The role of evolutionary physics (synergetics) in accordance with the principle of fundamentalism, dynamic problems, self-organization of systems, their evolution and others.
- The content structure of the general physics course should include:

- separation of the invariant nucleus;
- linear selection of four contents in the core, combining the study material around it:
subject - development of fundamental physical knowledge-invariant nucleus;
ideological - possession: physical ideas about time "depiction of the world through sequence; mechanical; electrodynamic, quantum field, understanding of the universe; evolution;
understanding of methodological research methodology: knowledge; development according to the main stages of physical theory: classical, non-classical (quantum-mechanical), (evolutionary-synergetic);
mastering modern mathematical methods and computer modeling methods in the course of information and mathematical-general physics;
- to present from the studied material in accordance with the logic of scientific knowledge as a natural way to consider the directions of the above content, corresponding to the process of formation of physical theory; fundamental physics.

The formulated rules of the concept serve as a basis for future engineers to build a methodological model of differential teaching of general physics [4].

The methodological model includes several subsystems. The first is the "teacher-student" subsystem (Figure 1), in which interactions are made through subject content and learning technologies [1]. The second subsystem of interaction of methodological components is: methodical system. It includes the traditional components for any methodological system: targeted, meaningful, technological ("learning" methods, forms, and tools) and diagnostics of learning outcomes (Figure 2).

Figure 1. Model of methodical system "Teacher-student" in teaching physics

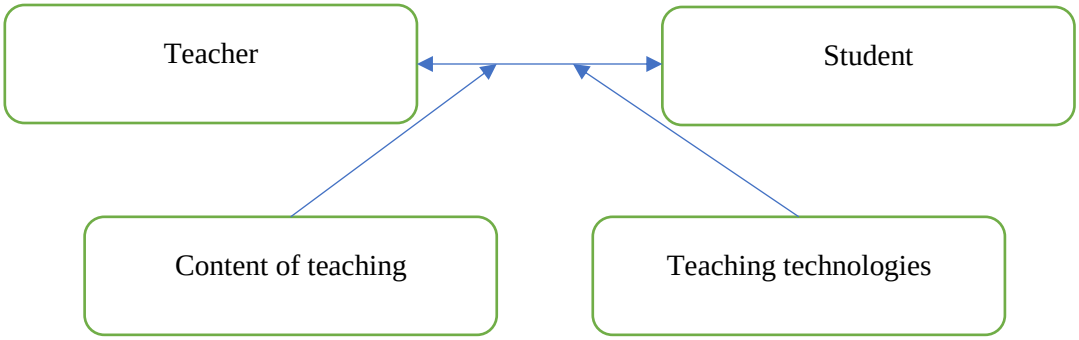
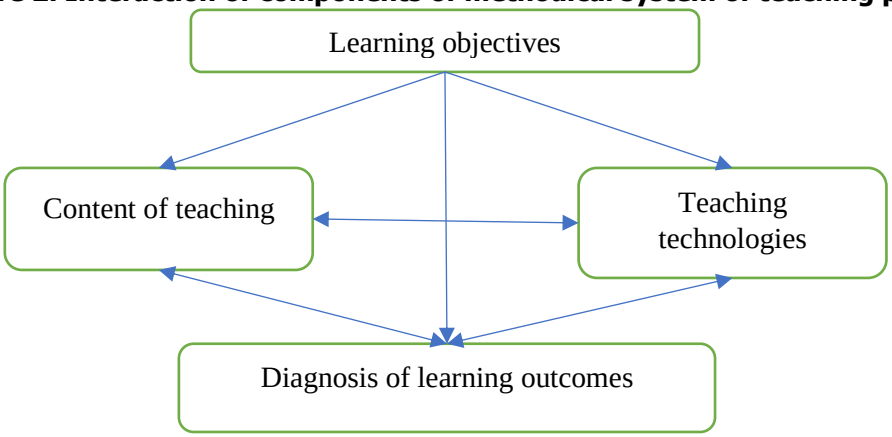


Figure 2. Interaction of components of methodical system of teaching physics



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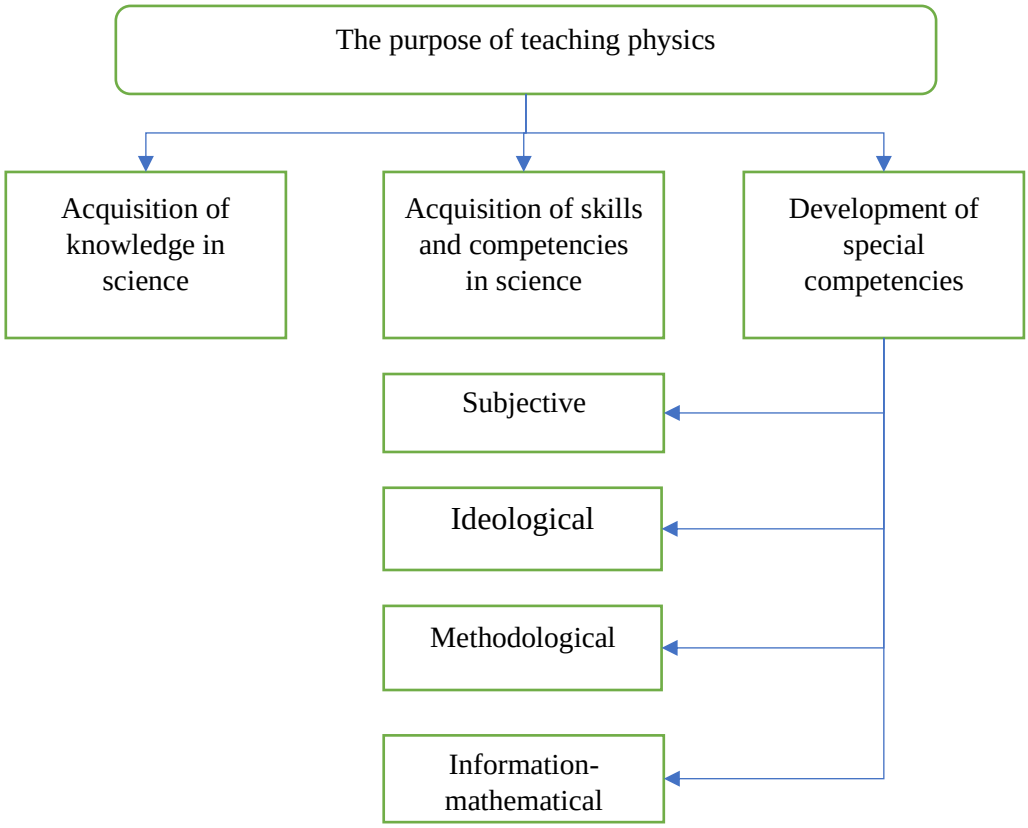
The target model of the methodological system shown in Figure 2 is illustrated: teaching: general: physics. This model includes the main objectives of teaching students general physics: subject and non-traditional (worldview, methodological) acquisition of knowledge, topic theoretical research, solving various problems, etc. (experimental and experimental work), and general education (information, communication, organizational and others), as well as the acquisition of knowledge and skills, ie the ability to apply them in solving various problems arising in the engineering profession, in other words, the development of special competencies; as justified above, such specific competencies include subject matter, methodological, ideological information, and mathematical issues [3].

Figure 3. Objectives of the model of the methodical system of teaching physics



Separation of content lines corresponds to the task of forming students' subject knowledge in general and specialized subjects, which is the second part of the content block of the general physics course.

In accordance with the learning objectives, the sub-methodological system includes the component component itself and the process component (Figure 4). The target component includes subject knowledge, i.e. knowledge of general physics and subject knowledge.

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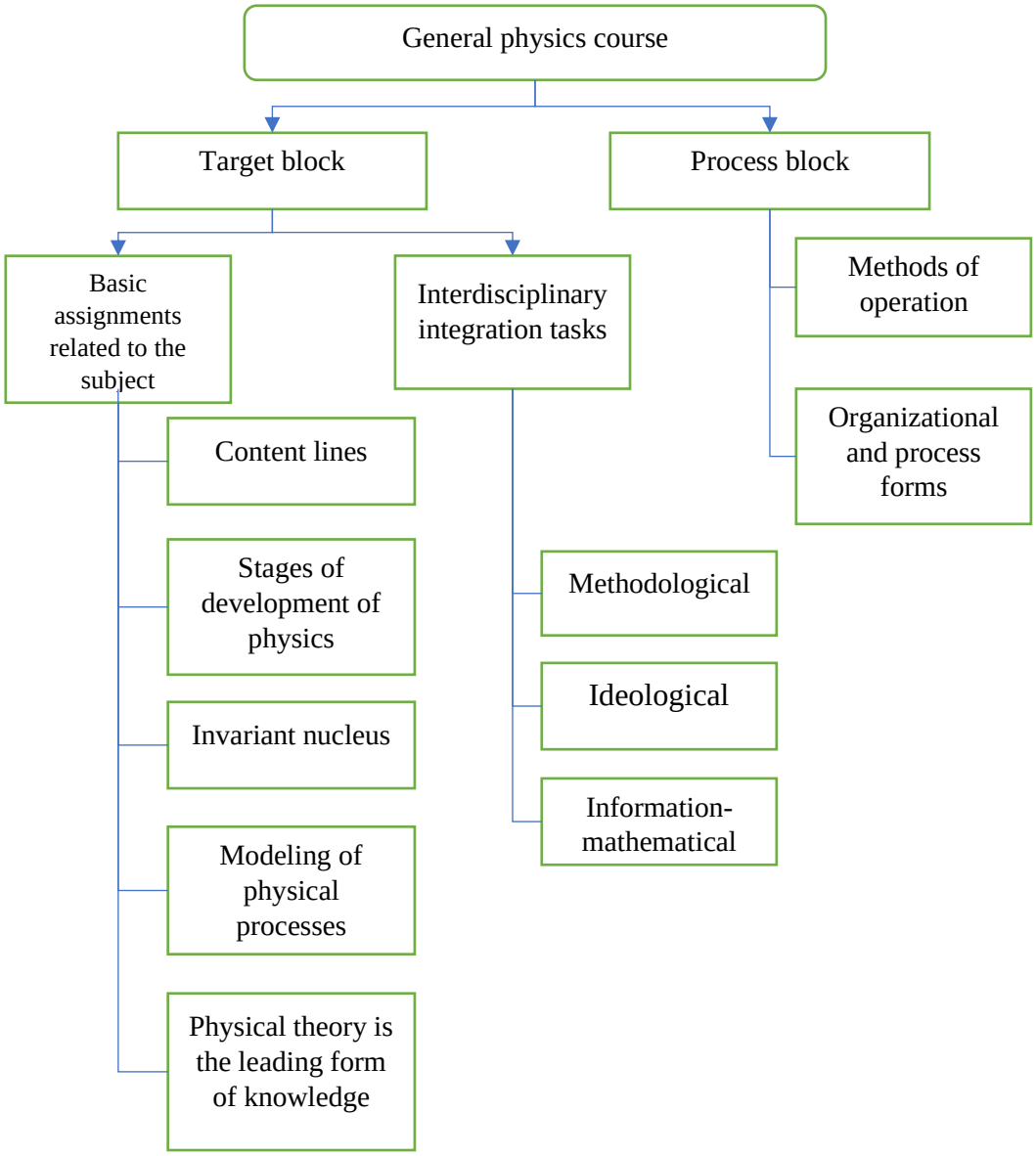
Figure 4. A meaningful model of the methodical system of teaching physics



In accordance with the basic rules of the concept of the methodical system of differential training of future engineers in physics, the specific features of the content of the physics course is the selection and presentation of content in it.

Development of physics education through linear connections such as subject, methodological, ideological, mathematical-informational, separation of stages of development of the content of physics course, implementation of content and logic construction based on the principle of fundamentality of physics education, study of students' views on the evolution of physics and reflect the structure of physical theories in the course structure.

In short, the purpose of teaching physics is to develop professional competencies such as subject, methodological, ideological, mathematical and informational. Furthermore, the content of the physics course is to distinguish the stages of development, to implement the construction of content, to study students' views on the evolution of physics, group the course material around fundamental physical theories, reflect the structure of physical theories in the course structure and logic on the basis of the principle of fundamentalism in physics education.

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