A model for ensuring consistency in solving physical problems. (On the example of engineering activity)

Nosirov Nizomiddin Baratovich

Researcher of Chirchik State Pedagogical University, Senior Lecturer of Tashkent University of Architecture and Construction.
E-mail: nnb1990nnb@gmail.com.
tel. 97 543 33 00.
Based on the review of S.S. Khudaiberdiev, docent of the Department of "Mathematics and Natural Sciences", Candidate of Physical and Mathematical Sciences, Tashkent Institute of Architecture and Construction.

ABSTRACT

This article discusses specific features of the model for ensuring the harmony of solving physical problems in engineering activities, stages of organization and specific examples of its direct application. Here, the main principles of the modeling process, the formation of the main general professional competencies of the future engineer in the study of fundamental sciences, and the structural and substantive model of the general physics course are presented. Also, the stages of formation of the main general professional competencies of future engineers in the effective application of this model in the educational process are mentioned.

Keywords: physical issues, competence, coherence, model, modeling object, physics training, general physics, cycle.

Introduction. As it is known, it is very important to develop a methodology for the theoretical and practical training of the general physics course in the formation of the basic general professional competences of future engineers.

Due to the increase in the scope of tasks solved by engineers, a fundamental change is taking place in engineering activities in general, the content, goals and tasks of engineering work are changing and gaining new meaning. The tasks that engineers solve during their professional activities define engineering tasks that require certain qualities of graduates of higher education institutions.

Literature review

The method of modeling the development of professional competence of future specialists in pedagogical research is the most popular and effective. Researcher O.M. Vlasenko said that the model [from French. model, Italian. modelo, lat. modulus] concept is ambiguous and has different interpretations. The author evaluates the three most common interpretations of a model: as a type of specific design, as a model for creating copies, and as a representation of an object. According to the scientist, in pedagogical research, the model serves as a comparison of this object: person, action, behavior and communication.

The classification of models was considered in the work of O. N. Vlasenko, who distinguishes the following types: mental, speech, symbolic, figurative, rational, functional. The author notes that the most widely used models in pedagogical research are secondary images, which are generalized and structured representations of the object.

According to O.M. Kiseleva, the modeling method is one of the main ones for most

disciplines, including pedagogy, and consists of building, applying and studying mathematical models. O.M. Vlasenko describes modeling as a process of creating a model, observing and drawing conclusions based on the model. So, on the other hand, modeling can be presented as a simplification of system components that are not important to the system, if this does not affect the performance of the system.

The study of E.O. Lodatko, who described the main principles of the modeling process in pedagogical research, is of great interest; among them the following can be distinguished:

- it is perfectly legal for different authors to interpret the same pedagogical concept in different ways depending on the goals and context of the research;
- based on the results of one or more experiments, it is not possible to consider the complete picture of a particular pedagogical phenomenon;
- the process of modeling as a result of idealization, simplification, focusing on specific components allows to formalize the description of the pedagogical phenomenon and helps to use numerical methods for processing the results;
- one model cannot fully reflect all features and qualities characterizing the object;
- the main requirements for building a model are its information content, ease of use, compatibility with pedagogical principles, and the ability to control the model through certain components.

Based on the above analysis, **it should be noted that the model of the research work can be used in cases that allow studying the object not only in a static state, but also in the process of changing each of its components together or separately. It can be concluded that it is a guide that defines the algorithm of implementation in a clear sequence, which can be used for other users.**

In the framework of our research, the object of modeling is the process of forming the basic general professional competencies of the future engineer in the study of fundamental sciences. In this case, modeling involves simplifying some features of the object, otherwise the model will become awkward and lose its function. When building an authorship model, attention is paid to the following components:

1) The general physics course from the cycle of natural sciences studied by future engineers provides opportunities to form all basic general professional competencies;

2) Pedagogical opportunities that may include practical exercises, lectures, laboratory work, group and independent work elements that may be conducted within the framework of this training course.

As a result of the analysis of scientific and educational literature, three stages of formation of basic general professional competencies of future engineers were identified: initial, basic and final.

Content of stages of formation of general professional competences of future engineers

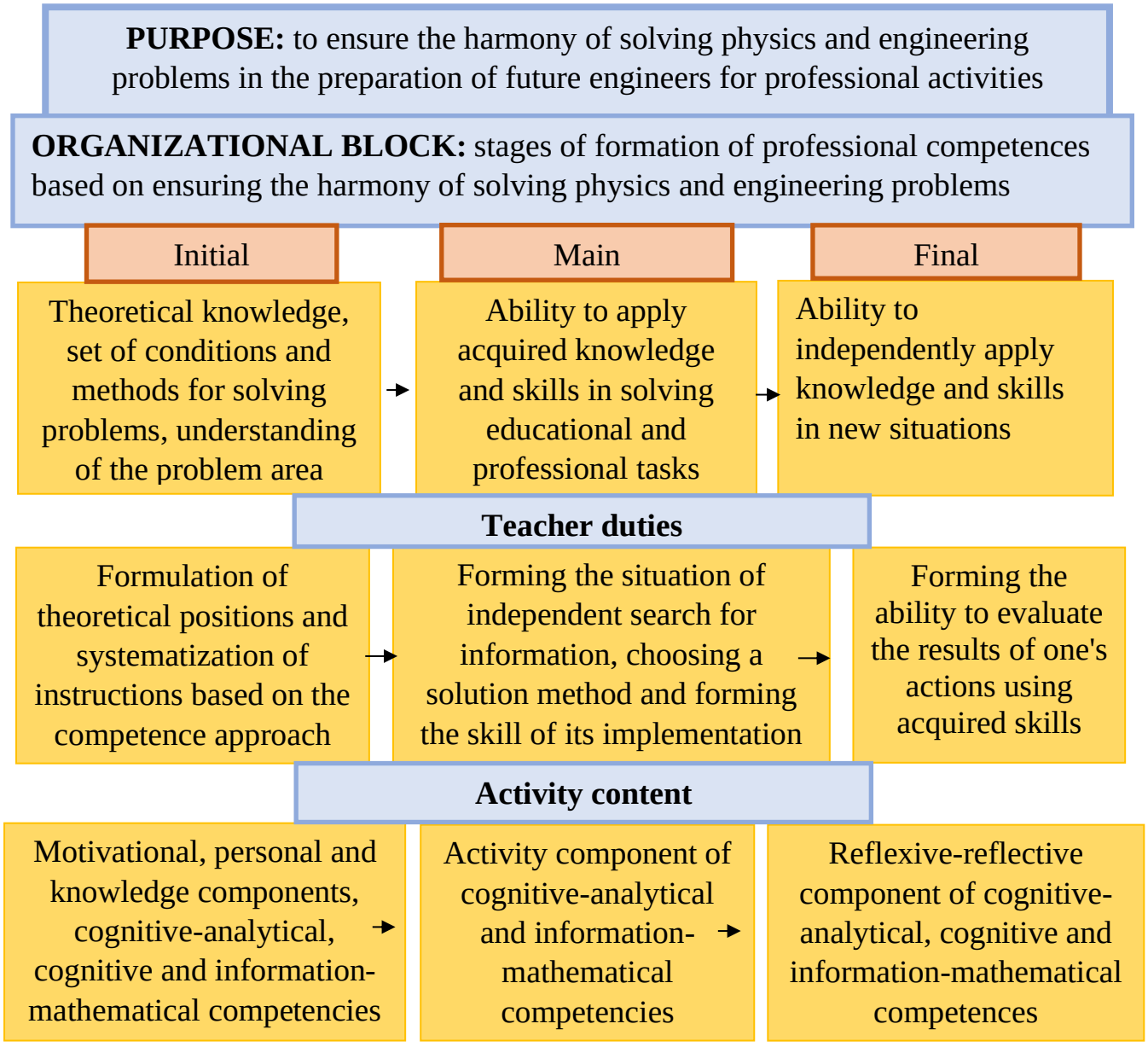
Stages	Initial	Main	Final
Tasks	- creation of a theoretical position from the point of view of competence approach; - systematization of instructions for solving educational problems.	- formation of students' interest and ability to find material independently; - forming the ability to independently choose and implement a sequence of problem solving.	- to develop the ability to evaluate one's own knowledge and skills; - to develop the ability to evaluate the decision made.

(Analysis and results. The model should be based on the following pedagogical principles: connection of theory and practice, activation of cognitive activity and problem-based approach to the creation of teaching content, intensification of the educational process,

orientation to activity. In order to ensure the successful operation of the model, we have chosen systems and competence approaches that allow us to analyze and structure the components of the proposed model as part of our research, as well as to consider the teaching process of a general physics course as the most optimal basis for the formation of professional competence of a future engineer. The developed structural and substantive model of the implementation of the professional direction of the general physics course consists of the following blocks: **purpose, teacher, content, form and method and tools, student, assessment and correction**.

The application of the proposed model was carried out at the initial, basic and final stages, each of which constitutes a specific component of the basic general professional skills, as it prepares future engineers for professional activities in the course of studying general physics.

The main purpose of using the model is to provide career-oriented general physics course to future engineers. The target block includes intermediate goals set for each stage of research, and the "teacher" block includes tasks to be solved step by step by the teacher.



A model of the implementation of professional orientation in the study of a general physics course

So, at the **initial stage**, the intermediate goal is to expand students' understanding of the problem area as a set of theoretical materials, conditions of educational tasks and ways to solve them. As a result, the teacher was given the following tasks: to compile the material in the general physics course from the point of view of the competence approach; systematization of educational problem solving tools; generalization of practical knowledge of mathematics and computer science necessary for solving educational problems; helping to create a "state of success" in solving educational tasks.

At the main stage, the intermediate goal is to develop students' ability to apply their knowledge and skills in solving educational and professional tasks. This goal sets the following tasks for the teacher: to develop the ability to analyze a problematic (production) situation; formation of students' interest and ability to find additional necessary material on their own; to form the ability to independently choose a sequence of problem solving; to imagine a problem situation, to form the skill of obtaining a numerical description.

At the final stage, the intermediate goal is to develop the ability to independently apply knowledge and skills in new situations. In accordance with these goals, the teacher was assigned the following tasks: forming the ability to evaluate one's own knowledge and skills; formation of the ability to create algorithms for solving educational (production) problems based on generalization and systematization; formation of the ability to evaluate the obtained solution; actively involve students in the process of structuring the studied material.

Conclusion/Recommendations.

In conclusion, during the course of general physics training forms, methods and practical training in general physics will be carried out with the implementation of the structural model based on the integration of traditional and competence-based approaches developed in accordance with the tools used, as well as with the continuous formation of the professional competence of the engineer. The effectiveness of the model is ensured by the coordination of the interdependence of the stages (initial, basic and final) in which the main activity of students is changed (from passive and reproductive to active and creative) motivation (external to internal), and the reflection of professional actions is formed.

Proposal: In the course of general physics, the use of a model of practical exercises and tasks oriented to professional activity in the process of solving problems will help to gradually form important professional qualities of a future engineer.

References

1. 1.Nosirov, N.B. (2022). Educational-methodical support for solving engineering problems from physics and its stages. Integration of science, education and practice. Scientific-methodical journal, 3(10), 98-103.
2. 2.Begmatova D.A., Nortojiyev A.M., Khudayberdiyev S.S., Mahmadiyorov A.Z., Nosirov N.B. The importance of physical exercises in the training of specialists in the field of architecture and construction // International Conference on Problems and Perspectives of Modern Science. AIP Conference Proceedings 2432, 030056 (2022); https://doi.org/10.1063/5.0089959 Published Online: 16 June 2022.
3. 3.Baratovich, N.N. (2023). Study and methodology of solving engineering problems in physics. Conference, 64-67.
4. 4.Baratovich, N.N. (2023). Physical-engineering problems stages of solution and its didactive tasks. Conference, 102-104.
5. 5.Uralbaevich, T. I., Baratovich, N. N. (2023). Formation of main general competences of future engineers and its stages. Conference, 80-83.
6. 6.E. B. Saitov., Sh. Kodirov., Z. F. Beknazarova., B. M. Kamanov., A. Nortojiyev., N. Siddikov. Developing

Renewable Sources of Energy in Uzbekistan Renewable Energy Short Overview: Programs and Prospects. // International Conference on Problems and Perspectives of Modern Science. AIP Conference Proceedings 2432, 020015 (2022); https://doi.org/10.1063/5.0090438 Published Online: 16 June 2022.

7. 7.Baratovich, N.N. (2023). A model for implementing professional orientation by future engineers in the general physics course. For Teachers, 16(1), 178-183.
8. 8.Gareth Jones. "Competence and Understanding—A Personal Perspective" Selected Contributions from the International Conference GIREP EPEC 2015, Wroclaw Poland, 6–10 July 2015 u. P. 11-24.
9. 9.Baratovich, N.N. (2023). Modeling method of professional competence development of future engineers. For Teachers, 16(1), 184-188.
10. 10.Mukhamadalievich, N.A. (2022). The method of conducting practical classes in the subject of physics in technical higher educational institutions through the method of designing objects of professional activity. Asian Journal of Research in Social Sciences and Humanities, 12(5), 350-354.
11. 11.Khudaiberdiev, S.S., Nortojiev, A.M. (2022). The method of conducting practical training in physics in technical higher education institutions through the design method. Journal of Integrated Education and Research, 1(7), 104-109.
12. 12.Begmatova D.A., Nortojiyev A.M. Integration of conducting physics classes in higher educational institutions in the field of construction// Scientific information of Tashkent State Pedagogical University. - Tashkent, 2020. - #12. - B. 40-45.
13. 13.Nortojiyev A.M. Methods of ensuring integrative approach to teaching physics // International Multidisciplinary Conference on Scientific Developments and Innovations in Education. - Greece, 2022. - P 19-21.
14. 14.Nortojiyev A.M. Teaching physics on the basis of integration of architecture and building sciences // International Conference on Developments in Education, Sciences and Humanities. – Hosted from Washington, DC USA, 2022. – P. 116-117.
15. 15.Mukhamadalievich, N.A. (2022). Formation of the professional competence of students through the interdisciplinary integration of physics into the sciences of architecture and construction. Conference, 170-172.
16. 16.Nortojiyev, A.M., Begmatova, D.A. (2021). Methods of conducting physics laboratory courses on the basis of interdisciplinary integration. Academic research in educational sciences, 2(CSPI conference 3), 105-107.
17. 17.Nortojiev, A.M. (2023). Formation of professional competence of students through integration of physics in architecture and construction sciences. For Teachers, 16(1), 189-194.
18. 18.Tashpulatov, S. and Parmanova, R. (2021) Spectra of the Energy Operator of Four-Electron Systems in the Impurity Hubbard Model. Triplet State. Journal of Applied Mathematics and Physics, 9, 2776-2795. doi: 10.4236/jump.2021.911179.