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Training For Future Engineers In Physics On The Differential Approach To Laboratory Activities

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ABSTRACT

This article presents the principles of developing the professional competencies of future engineers of higher education institutions through the development of project models of teaching physics based on a differential approach in laboratory classes.

KEYWORDS

Did actic principle, synergetic principle, cultural competence, methodology, concept, nonlinear learning trajectories, differential education, innovative education, bifurcation.

INTRODUCTION

In the philosophical encyclopedia, differential (Latin differentia - difference) is the division of the developing whole into parts, stages, levels. The term "differential" is widely used in science, and Spencer saw differentiation and integration as key points in the general evolution from the simple to the complex at the biological, psychological, and social levels. creating conditions to meet their learning needs and interests [1].

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The construction of nonlinear learning trajectories within physics can be accomplished using differential learning. In addition, the purpose of building nonlinear learning trajectories is to improve the quality of education, ie the formation of high-level competencies or expand their range. reflects the possibility of providing. This principle provides the greatest degree of individualization of education. The implementation of this principle can be achieved not only through elective courses in the changing part of the curriculum, but also through the creation of different educational programs using innovative educational technologies to ensure variability and non-linearity within a separate module or subject [2].

In the implementation of this methodical system, laboratory training in physics is also carried out in two forms: active and interactive. In both cases, the proposed methodological model forms the general professional competencies of students, for example:

- To be able to use the basic laws of natural sciences in professional activities, to apply theoretical and experimental research methods;
- The ability to determine the natural-scientific nature of the problems that arise in the process of professional activity, to involve them in solving the appropriate physical and mathematical apparatus;
- Search, storage, processing and analysis of information from various sources and databases, presentation in the required format using information, computer and network technologies.

It can be seen that this type of cognitive activity forms general professional competencies.

The following are formed from the general cultural competencies in the conduct of laboratory work in an interactive form:

- Ability to communicate verbally to solve problems of interaction;
- Ability to work in a team.

As noted above, the interactive form of conducting laboratory classes involves the interaction of students in small groups, which is partially carried out in the traditional form of education: students do laboratory work in groups of 2-3 people, but tasks for strong and weak students are offered to everyone the same, without exception. However, most tasks are performed by strong students [4].

MATERIALS AND METHODS

In the experimental part and in the theoretical questions in the selection of tasks of different levels of complexity, each student is given the opportunity to work at an individual comfortable level: basic, advanced or advanced (research laboratory work).

Advanced work involves the use of the proposed training material in the theoretical part of the description of laboratory work.

In order to carry out research laboratory work, the student must independently find the information necessary to study certain relationships of physical quantities, think during the experiment and suggest a form of presentation of the results obtained [5].

The following general cultural competencies are formed through active laboratory work:

- Ability to self-organize and self-educate;
- Ability to communicate in writing in interpersonal collaboration.

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An active form of student learning activity can be implemented in the process of performing virtual laboratory work that the student can perform individually without relying on anyone's help.

Schematically, a model of constructing open learning trajectories during laboratory sessions is shown in Figure 1. As can be seen from the figure, nonlinear learning trajectories are realized by providing the possibility of independent selection [5].

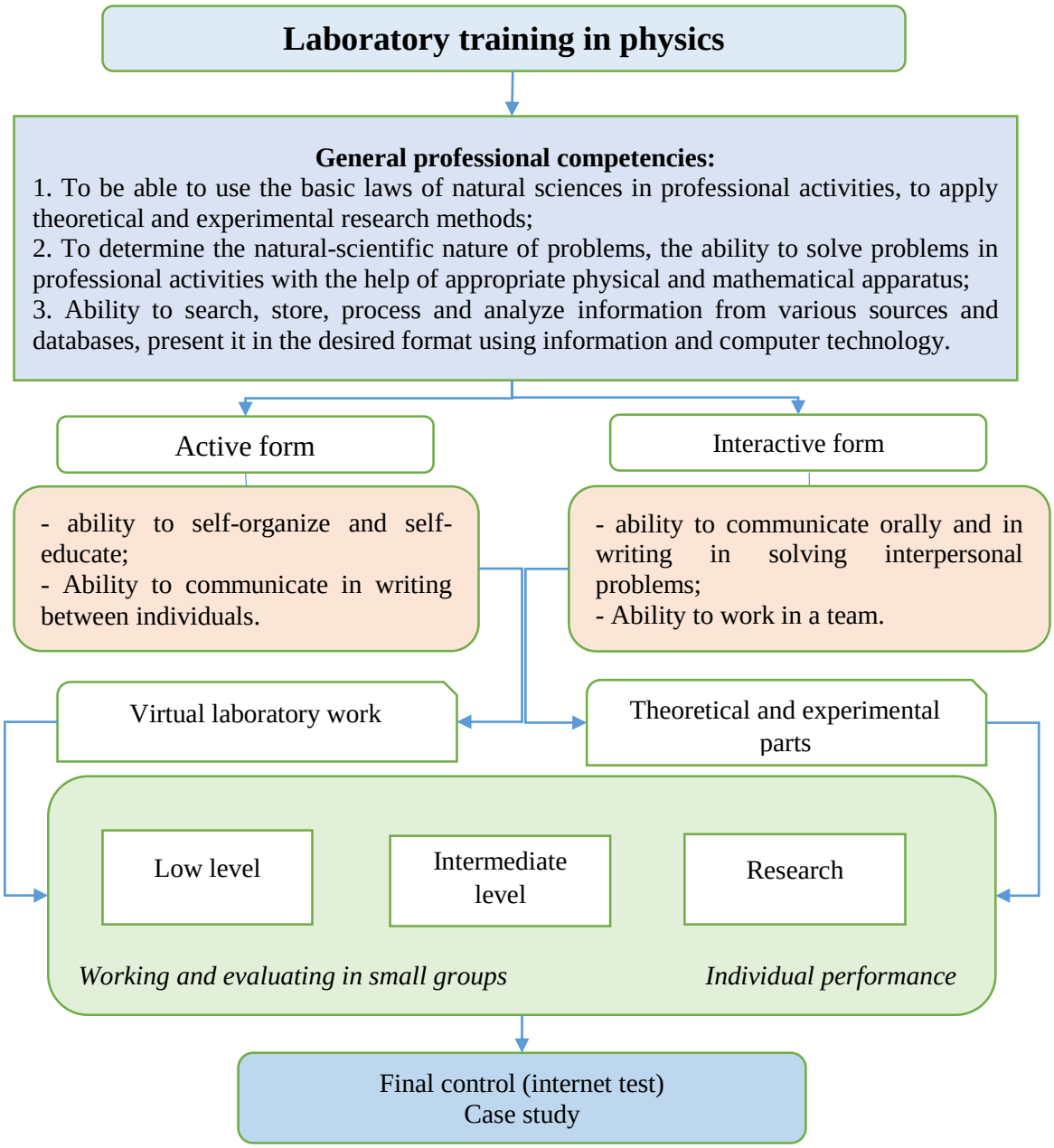

Figure 1. Methodical model of construction of open learning trajectories during laboratory classes

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Within the framework of the methodological model, laboratory work is carried out at different levels of complexity, and the choice of level of complexity is optional. Students are offered practical assignments at three levels (basic, advanced, and research), and the theoretical part has two levels of complexity of the task performed [6].

CONCLUSION

Thus, the openness of the educational process from the scope of compulsory subjects is realized by taking into account the individual characteristics of students, both in the creation of bifurcation points and in the performance of the experimental part, as well as in the defense of laboratory work. As a result of the implementation of a differential approach in physics laboratory classes, it is important to develop the necessary professional competencies (design, construction, research) and professional qualities of future engineers. It is necessary to develop the integration of pedagogical and technical sciences on the basis of a differential approach in the process of laboratory training, as well as to implement a systematic approach to the technological development of engineering training.

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