Volume 2, Issue 10, October - 2024 **ISSN (E):** 2938-379X

ORGANIZING PHYSICS LABORATORY SESSIONS BASED ON DIFFERENTIATION

Imomov Obidjon Elamonovich
Senior Lecturer, Department of "General Physics"
Qarshi Institute of Engineering and Economics
Tel.: 91 464-77-27, e-mail: Imomov_1985@bk.ru

Abstract
This article discusses the principles of developing professional competencies in future engineers through the implementation of project-based models in differentiated approaches to physics laboratory sessions in higher education institutions.

Keywords: didactic principles, synergetic principles, cultural competence, methodology, concept, nonlinear educational trajectories, differential education, innovative education.

Introduction

The construction of nonlinear educational trajectories within the framework of physics can be achieved through differential learning. Furthermore, the goal of building such trajectories is to improve the quality of education, which involves forming high-level competencies or expanding their spectrum [2].

The principle of variability and nonlinearity in educational trajectories provides students with a wide, comprehensive, unique, and attractive array of options, provided they make adequate and meaningful choices. This principle ensures the highest level of individualization in education. The implementation of this principle can be carried out not only through elective courses within the flexible part of the curriculum but also by creating various educational programs that ensure variability and nonlinearity within individual modules or subjects using innovative educational technologies [3].

In implementing this methodological system, conducting laboratory sessions in physics is carried out in two forms: active and interactive methods. In both cases, within the framework of the proposed methodological model, students' general professional competencies are formed, such as:

- The ability to apply the fundamental laws of natural sciences in professional activities and to utilize theoretical and experimental research methods;
- The capability to identify the scientific nature of problems arising during professional activities and to involve appropriate physical-mathematical tools to solve them;
- The ability to search, store, process, and analyze information from various sources and databases and present it in the required format using information, computer, and network technologies [4].

As noted above, the interactive format of conducting laboratory sessions involves students' interactions within small groups, partially realized in traditional education forms.

Laboratory work is done in groups of 2-3 students, but tasks are equally assigned to all, without exception, regardless of whether students are strong or weak. However, in most cases, stronger students tend to complete the tasks [5].

Performing at an advanced level involves using the educational material proposed in the theoretical part of the laboratory work description. To perform scientific-research laboratory tasks, students must independently find the necessary information to study certain relationships of physical quantities, reason during the experiment, and propose a format for presenting the obtained results.

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

- The ability to self-organize and self-discipline;
- The ability to communicate in written form during interpersonal collaboration.

The active form of a student's educational and cognitive activity can be implemented during the execution of virtual laboratory work, which the student can complete individually without relying on anyone else's help.

Students are offered experimental tasks at three levels (basic, advanced, and research tasks), with the theoretical part having two levels of complexity. When conducting laboratory work using a differential approach, we divide the class into three small groups: "low level," "intermediate level," and "research" groups. Based on the capabilities of each group, we engage in individual work with them. The laboratory assignments are provided according to the groups' abilities.

For example, when performing the laboratory task "Recording and Analyzing Free Fall Results Using VideoCom" in the mechanics section, the process is organized as follows. For the "low level" group, we suggest the virtual version of determining the "acceleration of free fall," as this virtual laboratory version is simple and understandable for the group members. They will collaborate, using the computer to gather the results and complete the assignment together.

For the "intermediate level" group, we recommend using a mathematical pendulum to determine the acceleration of free fall, considering their abilities. The group members' knowledge and skills are sufficient to calculate the acceleration of free fall by counting the oscillations of the mathematical pendulum. They will measure the necessary quantities and use the working formula to calculate the value of the acceleration of free fall.

For the "research" group, which consists of the most advanced students, we suggest the task "Recording and Analyzing Free Fall Results Using VideoCom." These students will use the computer and the VideoCom program to determine the acceleration of free fall and draw the necessary conclusions.

Thus, by creating bifurcation points and considering the individual characteristics of the students both during the experimental part and in the defense of the laboratory work, the nonlinearity of the educational process within the framework of mandatory subjects is implemented.

References:

1. Смолкин, А.М. Методы активного обучения: [Метод. пособие для преподавателей и организаторов проф. и экон. обучения кадров] / А. М. Смолкин. – М: Высш. шк.,1991. – с.175
2. Пурышева, Н.С. Методические основы дифференцированного обучения физике в средней школе[Текст]: дис...д-ра пед.наук: 13.00.02. – М., 1995. – 518 с.
3. Imomov Obidjon Elamonovich, (2021). Training For Future Engineers In Physics On The Differential Approach To Laboratory Activities. The American Journal of Social Science and Education Innovations, 3(02), 396-399.(https://theamericanjournals.com/index.php/tajssei/article/view/1460)
4. Imomov Obidjon Elamonovich. A methodological model of building non-linear learning trajectories during practical lessons. American Journal of Pedagogical and Educational Research.ISSN (E): 2832-9791. Volume 8, |Jan., 2023(https://americanjournal.org/index.php/ajper/article/view/349)
5. Obidjon Elamonovich Imomov. Methodological model of differential education in teaching physics. World Bulletin of Management and Law (WBML).Available Online at: https://www.scholarexpress.net.Volume-5, December-2021.ISSN: 2749-3601(https://www.scholarexpress.net/index.php/wbml/article/view/360)
6. Vlasov, V. G. (2009). Interactive Teaching Methods in Higher Education. Moscow: Akademia.
7. Adibov, A. T. (2017). Methods of Active Learning in Physics Laboratory Work. Saint Petersburg: SPbGU.