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STUDYING PHYSICS IN SECONDARY SCHOOLS OF VIETNAM BASED ON THE THEORY OF EXPERIMENTAL LEARNING

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Abstract

Relevance is due to the requirements of the state (Vietnam) for secondary school graduates and the discrepancy between the existing school education in physics and modern standards.

Goal. The article deals with the problems of developing experience in solving educational and life problems in Vietnamese secondary school students based on the theory of experimental learning and the use of the Kolb cycle.

Procedure and methods. Analysis of scientific literature, observation, modeling, analysis of research results.

Scientific novelty/theoretical and/or practical significance. Examples of educational activities of secondary school students in Vietnam based on the theory of experimental learning in the study of electrodynamics are given. These specific examples help teachers to apply the proposed model of learning activities in the study of the course of physics as a whole.

Results. A model for designing learning activities in physics based on the theory of experimental learning in secondary schools in Vietnam.

Conclusions. The construction of the educational process in physics on the basis of the theory of experimental learning will allow students to develop the following competence – the readiness to solve educational and life problems.

Keywords: secondary schools in Vietnam, experimental learning theory, Kolb's learning cycle, experience in solving educational and life problems, course of Physics

ИЗУЧЕНИЕ ФИЗИКИ В ШКОЛАХ ВЬЕТНАМА НА ОСНОВЕ ТЕОРИИ ЭКСПЕРИМЕНТАЛЬНОГО ОБУЧЕНИЯ

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Аннотация

Актуальность обусловлена требованиями государства (Вьетнам) к выпускникам средних школ и несоответствием существующего школьного образования по физике современным стандартам.

Цель. В статье рассматриваются проблемы у учащихся средних школ Вьетнама, связанные с решениями учебных и жизненных задач на основе теории экспериментального обучения и использования цикла Колба.

Методы исследования. Анализ научной литературы, наблюдение, моделирование, анализ результатов исследования.

Научная новизна / теоретическая и/или практическая значимость. В статье представлены примеры учебной деятельности учащихся средних школ Вьетнама на основе теории экспериментального обучения при изучении электродинамики. Эти конкретные примеры помогают учителям применить предложенную модель учебной деятельности при изучении курса физики в целом.

Результаты исследования. Разработана модель проектирования учебной деятельности по физике на основе теории экспериментального обучения в средних школах Вьетнама.

Выводы. Построение учебного процесса по физике на основе теории экспериментального обучения позволит формировать у учащихся компетенцию – готовность решения учебных и жизненных задач.

Ключевые слова: средние школы Вьетнама, теория экспериментального обучения, цикл обучения Колба, опыта решения учебных и жизненных задач, курс физики

INTRODUCTION

The development that is taking place throughout the country in all spheres of public life in Vietnam sets a high bar for teachers in preparing students to graduate from their schools as conscious and highly educated people, as well as so that in the future they will be able to take an active social position in society.

Currently, the main task of general education in Vietnam is the formation of skills to work independently, to build a system of their knowledge based on their own needs, capabilities, aspirations, as well as to ensure the development and application of social experience.

The content of physics education should contribute to the formation of readiness for the application of theoretical knowledge and scientific methods of cognition of the surrounding world for the successful solution of educational and life tasks.

Thus, in the field of education in Vietnam, there is a search for new forms of education, as well as new educational technologies are being created.

One of the priority directions of the development of general education is the transition to new educational standards, the methodological basis of which is a system-activity approach. The theory of experimental learn-

ing is one of the modern methods that meet the requirements of education [7].

THE MAIN PART

Objective and tasks of research

The aim of the work is to study the problems of formation of the experience of solving educational and life tasks in secondary school students in Vietnam based on the theory of experimental learning and the use of the Kolb's cycle. The objectives of the study were:

- justification of the choice of the theory of experimental training for the effective study of physics by students of Vietnam and, in particular, electrodynamics;
- selection of measures for the organization of experimental educational activities;
- implementation of the Kolb's cycle in the design and organization of experimental activities in physics in secondary schools in Vietnam.

Methodology and methods of research

The analysis of scientific literature made it possible to determine the choice of the theory of experimental learning as a necessary and sufficient basis for building the educational process in physics (J. Dewey, K. Rogers, J. Piaget, K. Levina, D. Kolb), to justify the choice of measures for organizing the educational process in physics based on the

theory of experimental learning (S. A. Kholina, A. V. Popova, L. A. Proyanenkova, Nguyen Vu Anh, etc.). Observation of the educational process in physics in modern secondary schools in Vietnam has shown the possibility of effective implementation of the Kolb's cycle in physics lessons. During the study, the educational process in physics was modeled in various forms of its organization and the results of the study were analyzed.

Organization of research and progress of work

The theory of experimental learning. The theory of experimental learning is focused on students and their practical activities, in which the main focus is on the learning process, not its product. This creates an environment in which students can reflect and apply their experiences in real situations.

The theory of experimental learning is based on the work of many scientists who gave impetus to the development of their own theories of learning and human development, such as John Dewey, Carl Rogers and Jean Piaget. They argued that the development of a dynamic holistic model of the learning process would be one of the incentives for the development of students [4; 5].

There are various definitions of experimental learning. Here are some of them:

– «Tell me and I'll forget, show me and I'll remember, let me do and I'll understand». Confucius, around 450 BC [6, p. 2447].

– «Experimental education» – this is a philosophy and methodology in which teachers purposefully interact with students, share their experiences and certain reflections directly in order to acquire new knowledge, develop skills, and determine the value of learning¹.

– A learning process based on involving children in learning activities, encouraging them to think more, explore, ask questions, make decisions and apply the knowledge gained in real situations [6].

– «Experimental learning is a process in which knowledge is created through the transformation of experience» [5, p. 41].

Good results in experimental training are achieved using the Kolb's cycle.

Kolb's experimental education cycle. David Kolb is a scientist and educator specializing in experimental learning, as well as career development and vocational education. When creating his learning model, he used the works of John Dewey, Jean Piaget and Kurt Levin, and his theory is still used in the development of educational programs.

Theory of Kolb's experimental learning – a four-stage cycle [4; 5]:

1. A specific experience is the acquisition of a new experience or a new interpretation of an old one.

2. Observation and reflection – observation of any new experience. In this case, the experience itself and its understanding do not correspond to each other.

3. The formation of abstract concepts, that is, the building of a new representation, as well as the modification of an already existing abstract idea.

4. Active experimentation, that is, the application of experience in new conditions, experimental verification.

Training is effective if the student goes through all four stages of the cycle, since all cycles are interrelated and must be applied in a complex: he gets a new experience, reflects on it, then analyzes and draws conclusions that he applies in practice to test the hypothesis, which accordingly leads to a new experience again.

Characteristics of experimental learning. Experience is the basis and incentive for learning. Any experience potentially contributes to learning. Teachers pass on their valuable experience to students so that they can become interested and build their own learning based on this, therefore, the involvement of students in the educational process is the foundation of all subsequent learning.

Kolb gives many characteristics of experimental learning. He came to the conclusion that learning is best viewed from the point of view of the process, not the result. This pro-

¹ What is Experiential Education? Association for Experiential Education. Available at: <https://www.aee.org/what-is-experiential-education> (accessed: 12.10.2012).

cess should identify the beliefs and ideas of students so that they can be trained and integrated into work with new ideas [1; 5; 6; 7].

However, learning requires conflict resolution, since these conflicts and disagreements are what drives the learning process, since learning is not just the result of cognition, it includes complex functions of thinking, feelings, perception and human behavior. Thus, learning is the result of the combined interaction of a person and the environment, and occurs through the assimilation of new experience [1; 8].

Measures for the organization of experimental educational activities in teaching physics in schools in Vietnam. Among the main measures of the organization of the educational process in physics based on the theory of experimental learning are [2; 9; 10]:

- increasing the practical orientation of the teaching material of physics lessons;
- the use of experiments in the educational process;

- changing the form of assessment of the quality of student learning outcomes.

Table 1 shows the goals, characteristics and methods of applying measures to organize the educational activities of Vietnamese students in the study of physics.

Here are some forms of organizing experimental physics education in secondary schools in Vietnam (fig. 1) [1].

Sightseeing and holding a themed picnic is a modern form of organizing experimental training, arouses great interest among students in Vietnam. Students informally study machines and equipment used in industrial production, agriculture, transport,

Table 1 / Таблица 1

Steps to organize the educational process in physics based on experimental learning theory / Этапы организации учебного процесса по физике на основе экспериментальной теории обучения

Measures for the organization of experimental educational activities	Specifications	Objective	Method of application
Increasing the practical orientation of the teaching material of physics lessons	Establishing the relationship of educational material with real life, analyzing realistic situations with the use of scientific knowledge	Helping students to learn about the world around them	Active forms of education, extracurricular activities
Using experiments in the educational process	Formation of general academic skills and abilities of students through practical activities during experiments in physics	Mastering the experimental method by students	A physical experiment to study the device and the principle of operation of laboratory devices using basic mathematical knowledge to collect and process experimental data
Changing the form of assessment of the quality of student learning outcomes	Assessment of students' knowledge, skills and abilities during testing and identification of the level of academic achievements in physics, as well as the search for new forms of assessing the experience of solving educational and life tasks	Identification of deviations from the norm of students' responses to physics test tasks	The system of tasks of the practical content test

Source: compiled by the authors.

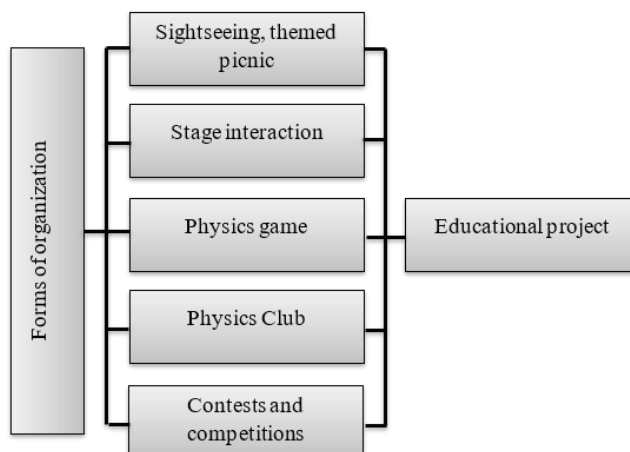


Fig. 1 / Рис. 1. Forms of organizing experimental teaching in physics in secondary schools in Vietnam / Формы организации экспериментального обучения физике в средних школах Вьетнама

Source: compiled by the authors.

communications; visit production facilities (for example, factories, hydroelectric power plants, wind farms), scientific and technical agencies, etc.

Stage interaction is carried out by students within the framework of theatrical productions recreating the process of discovering physical laws, illustrating biographies of physicists, real life situations related to the description, explanation and application of physical phenomena.

The physics game is a form of organization of educational events that involve the use by participants of their knowledge gained in physics lessons. The game can be used in open physics lessons, the content of which reflects the role of physics in shaping the culture of students, for example, solving environmental problems associated with obtaining electrical energy on a production scale.

The Physics Club is a form of extracurricular activity of high school students in Vietnam, who unite by interests, for example, when studying electrodynamics, the problem of using alternative sources of electrical energy is considered. Group members exchange opinions on the chosen problem with each other, with students of other groups and teachers.

The activities of the physics club include: organization of seminars, talks on physics problems related to real life; application of physics in science and technology [1].

Contests and competitions are one of the forms of organizing the activities of students with a high level of achievements in physics.

The purpose of organizing contests and competitions: to attract students to actively participate in the educational activities of the school; to meet the needs of students in entertainment; to develop students' creative abilities, the ability to positive activity and interaction, to stimulate interest in cognitive processes.

The scale of the competition and competitions can be within the class or the whole school. The subjects participating in the competition and competitions may be individual students or groups of students.

By conducting educational experimental studies of physical phenomena, students acquire the skills of observation, measurement, generalization of the results of experiments and the ability to apply knowledge in practice.

The main result of the application of the organization of experimental training in physics in secondary schools in Vietnam

in the educational process in physics is the organization and implementation of an educational project. The educational project is considered as a product of students' research activity, which is carried out under the supervision, guidance and assistance of teachers. Students complete the task for a long time, alone or in small groups.

The purpose of the educational project is to solve educational and life tasks with the application of knowledge in physics. This allows students to develop the skills of detecting and solving problems, higher-order thinking (analysis, synthesis, evaluation), teamwork and communication in a group; to form knowledge and achieve real results independently; to improve the skills of using information technology in the educational process when creating a product of an educational project [3].

Design and organization of experimental activities in physics. Applying the Kolb's experimental training cycle, we propose the process of designing and organizing experimental training in physics, implementing it in stages as follows:

Stage 1: determine the topic of training.

Stage 2: determine the purpose of the experimental activity.

Stage 3: determine the conditions, opportunities and competencies of students.

Stage 4: determine the content of the experimental training.

Stage 5: design the learning organization process based on the theory of experimental learning.

Let's consider the experimental activity of students during sightseeing (excursion to a technical facility). For example, a visit to a local power plant. It is advisable to use this form of organization of experimental training in electrodynamics for students of the eleventh grades of secondary schools. When studying electromagnetic vibrations and waves, students get acquainted with the device, the principle of operation of a transformer and an induction generator. The problem of obtaining alternating current and transmitting electrical energy to the consum-

er is formulated before the students. The topic of the training is formulated – production, transmission and use of electric energy, the object of the excursion is the hydroelectric power station of Rao Trang (Hue) (stage 1). The purpose of the excursion is determined: experimental activity to study the process of production and transmission of electric energy at hydroelectric power plants (stage 2). Before the excursion, students repeat the educational material when performing tasks and exercises on the following topics: Joule-Lenz law, electromagnetic induction, electromagnetic oscillations, alternating current, Ohm's law for an alternating current circuit. Students get acquainted with the description of the object, which reflects the hydraulic structures of the station (stage 3). The content of the experimental training includes (stage 4):

- the history of the construction of a hydroelectric power plant;

- the mission of the hydroelectric power station;

- advantages and disadvantages of hydroelectric power plants.

Following the results of the excursion, students prepare a report on experimental activities, the form of which they receive before the event. The content of the report reflects the results of the study of hydraulic structures (stage 5):

- conversion of energy to hydroelectric power plants;

- the design of the generator used at the Rao Trang hydroelectric power station;

- characteristics of transformers;

- diagram of electric power transmission lines to the consumer.

Thus, the process of organizing experimental training will have the following stages of studying physics material: concrete experience (experiment), observation and reflection, formation of abstract concepts, active experimentation, development of criteria and tools for checking and evaluating students' learning activities. The study involved Dong Hoi (Quang Binh), Vung Tau (Ba Ria-Vung Tau), Nguyen Chi Thanh (Hue),

Nguyen Van Troi (Khanh Hoa), organizations that provide training in higher schools, Pre school central university for nationalities in Nha Trang city (Khanh Hoa). Among the participants of the pedagogical experiment were six physics teachers and 508 students, of whom one teacher and 41 students of Nguyen Chi Thanh Secondary School (Hue) participated in the project of visiting the hydroelectric power plant.

Research results and their discussion

The application of the theory of experimental learning in the study of physics by students of secondary schools in Vietnam is important. This approach makes it possible to make students' activities in the physics lesson more effective, to choose the appropriate form of organization of experimental educational activities, to provide students with the opportunity to promote their own ideas and interests in the curriculum developed by teachers. This form has its own characteristics in Vietnam, which differ from the educational process in other countries. This will allow teachers to ensure the active participation of students in the educational process in physics and their achievement of a high level of competence in solving educational and life tasks.

CONCLUSION

The study showed the need to build an educational process in physics based on the theory of experimental learning. When studying electrodynamics, the formation of students' competence – readiness to solve educational and life tasks – will be carried out effectively, since the educational material of this physical theory is saturated with a large number of practical applications.

The practical and scientific novelty of the research is expressed in examples of the organization of educational activities of secondary school students in Vietnam based on the theory of experimental training in the study of electrodynamics, which can be used by physics teachers in professional activities and will help to implement the proposed educational model at all stages of studying the course of physics.

Further research involves the development and implementation of a system of tasks in electrodynamics in the educational process in physics of secondary schools in Vietnam for the formation of competence – readiness to solve educational and life tasks – at a high level.

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ПРАВИЛЬНАЯ ССЫЛКА НА СТАТЬЮ

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