

UDC 37

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**ESTABLISHMENT AND DEVELOPMENT  
OF PRACTICAL SKILLS FOR PEDAGOGICAL STUDENTS  
OF PHYSICS IN THE CREDIT COURSE SYSTEM AT UNIVERSITY**

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**Abstract.** Physics is an experimental science, in which experiments play an important role in studying and teaching skills for students. This article presents one number of measures to develop experimental skills for physical pedagogy students in credit training system.

**Keywords:** physics; formation of skills; experiments; practical skills.

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Experiments play a very important role in studying and teaching Physics. The experiment is both a teaching tool and a means of organizing cognitive activities for students, and a research tool for student.

Teacher can make good use of experiments and use them effectively in teaching methods if experimental skills for pedagogy students are developed. In particular, in the credit training system, there must be solutions to organize and manage training and appropriate teaching methods to help students form and practice good experiments skills in physics teaching

### **1. Experimental use skills of physical pedagogy students**

In our opinion, the skills of the experimental pedagogy of students include experimental practice skills and experimental teaching skills. Through the analysis of teaching activities of teachers with experiments, based on professional standards of high school, it is necessary to build a system of experimental use skills for pedagogy student to meet the requirements of practice. The system of experimental use skills should be trained, builded and developed synchronously for students with the following two groups (5.6):

| <b>Experimental practical skills</b>   | <b>Experimental teaching skills</b>   |
|--|---|
| Determine the purpose of the experiment  | Determine the purpose of teaching with experiments  |
| Select the experimental plan   | Select teaching methods with experiments  |
| Planning to use laboratory equipment   | Planning teaching with experiments  |
| Using experimental and assembly equipment  | Applying teaching methods to teaching situations with specific experiments  |
| Perform the procedures of the experiment   | Organize the implementation and management of experimental implementation processes in teaching   |
| <ul style="list-style-type: none"> <li>- Evaluate experimental results</li> <li>- Observe and record</li> <li>- Comment</li> <li>- Write a report</li> </ul> | Assessing students' learning outcomes through teaching with experiments: <ul style="list-style-type: none"> <li>- Evaluate students' observation skills</li> <li>- Evaluate students' opinions and comments</li> <li>- Evaluate students' writing skills</li> </ul> |
| Evaluation and improvement of experiments  | Evaluate and improve teaching with experiments  |

The above skill groups have relatively independent but not separated. They are complement and to support each other. If students have good practice skills, they will facilitate teaching with experiments. If students have good teaching and experimenting skills, they will contribute to the development of experimental and practical skills ability to evaluate and improve experiments.

**2. A number of measures to build and develop skills to use experiments for physical pedagogy students under credit training system**

The purpose of training methods under credit system in the university is to promote students' activeness in building learning plans as well as promoting positive, proactive and creative learning. This training method requires students to self-study as well as team work. To be able to practice the skills of teaching experiment practice for students, the following measures must be well implemented (1):

**Awareness of the role of experimental practice in physical teacher training**

It is necessary to make both teachers and students have a proper awareness of quality

teaching in experimental practice modules. Management measures are needed here but more importantly, there are various forms of experimental hands-on teaching practices for students to enjoy this subject. We promote practice in university experiments through competitions, and the content of practical experiments linked to reality, technology or clubs.

**Innovating the training program towards increasing the amount of experiment practice**

The physical teacher training program has long been theoretical. This limitation has many causes, but mainly due to the difficulties in facilities and teaching equipment of universities. Another cause is the teachers and students do not understand about the role of experiment practice. In order to have a team of physical teachers to meet high school teachers' standards, the training program must be fundamentally renewed. First of all, the amount of time required for the experimental practice modules must be increased. In addition, the content of the experimental exercises must be updated and supplemented.

The system of experimental exercises includes general knowledge blocks, major knowledge blocks and experiments to help build and develop professional skills. These tests are linked to the content and general physics program. In order for students to have the skills to use common experiments and general physics teaching skills, they should do real experiment and be familiar with the general physics teaching environment. In doing so, the training program must have modules with a reasonable amount of time for teaching and practicing pedagogy in simulated environment or the real teaching environment in high school (1, 2).

The content of experimental exercises need to be reformed in the surveying a natural phenomenon. It is necessary to design experiments so that the most content can be researched, can be measured in many quantities and built up a lot rules, laws that govern them, and test results can be used to teach in many different lessons. As for the experimental practice modules of the pedagogical knowledge block, it is required to include general physics tests. Today, modern experiments that connect computers are increasingly equipped in universities. We need to put these experiments in the content of teaching and create opportunities for students to use those experiments.

#### **Innovating methods and forms of teaching practice.**

The physics practice experiments of pedagogical students is essentially a process of experimenting with experimental ideas used in the teaching. If students have no previous ideas, then conducting experiments will not be useful in training experimental skills using experimental methods but only training assembly and operating skills.

In credit-based training, in order to improve the effectiveness of experimental practice, we should organize to enhance student's creativity, self-study, gradually changing from laboratory type "Cookbook Lab" to laboratory model of "Inquiry Lab". Before go-

ing to the laboratory, teachers need to teach students mastering the content and require the test. Beside, teachers should focus on helping students build skills to determine the teaching purpose of the experiment, identify options to do experiments, determine the options used in teaching content in high school.

Trainers should organize students to work in groups to complete the above content. At this stage, students should be encouraged to use physical teaching software such as Crocodile Physics, Physics, Interactive Physics ... to create virtual experiments to choose the optimal experimental plan. At the end of each experiment, it is necessary for student groups to present the experimental results, including the experimental plan, experimental assembly, reading and processing of measurement results and especially the experimental use experience in teaching specific lessons in general physics program.

#### **Innovating testing and evaluating skills of using experiments in teaching physics**

It is necessary to renew the examination and evaluation of experimental use skills for physical pedagogical students. Normally, for each experiment, students have to write an experimental report after doing the experiment. In this report, students must present quite a detailed description of the purpose and requirements of the test, experimental assembly plan, measurement results, processing and argumentation of the results obtained. These are indispensable minimum requirements for students. However, it is necessary to renew students' experimental skills. Teacher need to focus on assessing students' performance: Authentic / performance Assessment. This assessment allows quantification and evaluation of the proficiency level of skills in using experiments in teaching. There are 2 important assessment tools:

- Evaluate through the description tables (Rubric) in experimental teaching, identify specific tasks, evaluation criteria, describe evaluation criteria according to a level achieved, to carry out assessment,

joint assessment and self-assessment (ensure factors: objective, accurate and differentiated).

- Evaluate the construction of lesson plans with experiments.

A lot of skills are required when teachers use experiments in teaching. If student were absent, it is quite complex to assess the ability to perform in teaching with experiments. Therefore, in order to accurately assess, it is necessary to combine other assessment methods (objective test and multiple choice test, interview, execution in assumptions, observation, analysis of documents and tapes). videos etc). In order to assess the skills of using experiments in teaching, it is necessary for students to practice teaching with real experiments in the laboratory as a hypothetical class, "students" in the classroom. This is the students in the group and lecturers who play the role of observation, guidance and assistance.

### **Enhancing the application of information technology in teaching practice experiments**

Information technology plays an important role in innovating teaching methods, especially in forming and developing experimental practical teaching skills for students. It is possible to apply information technology at every stage of the experimental practice teaching process. Experimental theory lectures can be posted on the school website for reference by students before entering the laboratory. With computer-connected experiments, students will become familiar with modern measurement systems with high accuracy, large measurement data, quick, accurate data processing and calculation and demonstration of flexible measurement result in the form of tables or graphs. Instructors and students can use virtual experiments, simulation experiments, or video clips to innovate teaching practice labs. Virtual experiments can be used in the selection phase of the experiment.

The software supports the construction of virtual experiments that allow students to design different experimental options to find the

optimal experimental plan before conducting a real experiment. Virtual experiments will help students choose the optimal plan, avoiding possible risks in the laboratory. Virtual experiments, video clips also support the teaching of experimental theory before students do experiments in the laboratory. In addition, students can use virtual experiments to visualize or explain the nature of physical phenomena. In experimental teaching, virtual experiments can be used to design electronic lectures (4, 3).

**For example,** *"Examining Newton's Laws with Air Cushion"* is a shared test kit, capable of performing many experiments (measuring the velocity of linear motion, velocity measurement the average of linear motion is uniformly changed, measuring the instantaneous velocity of the fast linear motion evenly, the distance-time graph, the velocity – the time of linear motion steadily, measuring the acceleration of the motion rapid progress, test Newton's laws, measure gravitational acceleration, kinetic theorem, momentum conservation law – elastic collision, momentum conservation law – inelastic collision). The tests have many options. We organized for groups of students to study and discuss the theoretical basis from which to propose plans to conduct experiments and plans to use experiments in general physics teaching. The implementation process can be described briefly as follows:

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#### **Step 1:** Prepare the experiment.

- The groups develop experimental plans, study the theoretical basis (to support students, we create electronic documents, related materials ... posted online for students to reference), record go to "Group practice diary".
- Conduct virtual experiments: using virtual experiment software (can use software of

Nguyen Ngoc Hung and Pham Xuan Que, Interactive Physics, Crocodile Physic ...) to study and predict real results to propose a plan to conduct a real experiment.

**Step 2.** Perform real experiment.

In turn, conduct experiments according to the selected plan, compare data between experiments (it is possible to connect experiments with computers for easy analysis, storage ...). The next, it is necessary to argue the data obtained with the theoretical results and make conclusions and self-comment on the group.

**Step 3:** Evaluate, comment and comment to improve the experiment

**Step 4:** The groups propose a plan to use the experiment (if possible students should try to experiment with this experiment before the fake class to teach a specific content of spectral physics. information

**Step 5:** Students write experimental reports. After that instructors review reports and combine monitoring of the experiment process to evaluate students' experimental use results.

Thus, students propose a real experiment through virtual experiments. Based on the results of the self-study of each group, the student groups made a judgment on how to conduct experiments most effectively with the highest accuracy ... Both student and teachers general plan to improve teaching and learning.

### **3. Conclusion**

For physical pedagogy students, it is necessary to build and develop skills to use experiments including experimental practical skills and experimental teaching skills. This idea must be reflected in the training objectives and must be included in the physical teacher training program. With the characteristics of training under credit system, it is necessary to have appropriate forms of teaching practice and experiments. Training programs need to be focused on strengthening self-study and group work of students. It is necessary to strengthen the application of information technology in innovating the organization of teaching and innovating the experimental practice teaching methods. The work of examining and evaluating the results of students' experimental practice should be specific through clear criteria. This content will be introduced in another article. Appropriate measures and implemented in a synchronous and persistent way will raise the skills of practical teaching and experiment of physical pedagogical students.

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