

О.М. Дружинина
ТюмГУ
кафедра МФПиС
доцент, к. п. н.
М.А. Елесина
ТюмГУ
кафедра иностранных языков
ст. преподаватель
Я.В. Ширшов
ТюмГУ
кафедра ММС
аспирант
yakovshirshov@yandex.ru

O.M. Druzhinina
Tyumen State University
Department of physics
Assistant professor
Candidate of Sciences
M.A. Yelesina
Tyumen State University
Department of foreign languages
Senior lecturer
Y.V. Shirshov
Tyumen State University
Department of Physics
Postgraduate student
yakovshirshov@yandex.ru

УЧЕБНЫЙ ЭКСПЕРИМЕНТ: ПУТИ СОВЕРШЕНСТВОВАНИЯ

THE TRAINING EXPERIMENT: THE METHODS OF IMPROVEMENT

At present modern school is required to improve considerably quality of education due to the high scientific level of teaching.

Therefore in the process of teaching it is necessary to take into consideration the individual differences of students as it becomes impossible to build the universal system of education which would be equally suitable for each student.

The highest priority of training is to be a student his or her development, perfection, tendency, wish to make his (her) own choice, interests, progress in learning, psychological peculiarities, ability to cognition.

To expose and develop students' abilities it is necessary to create the most favorable conditions at schools. The main idea is to introduce the elements of differentiation in the process of teaching.

The study of methods of teaching shows that there are a lot of various approaches to the differentiation in teaching physics. But unfortunately they are very seldom used at the classes of laboratory tests. Theoretically such methods are described in the works of such methodologists as U.I Dick, O.V. Kabardin and others. Their curricula and training appliances are meant to use at the lessons of advanced study of physics.

But as regards training appliances and methods of teaching physics for student of biological, chemical, humanitarian classes only a few works are devoted to this problem. There are some interesting papers written by L.G Burlakova, N.M. Evseeva and others where they suggest improving the training experiments at schools using some new investigations. The study of the problem under consideration in the school practice shows that:

1. The didactic material for training physics of students of others specialties but physics has not worked out yet. In the curricula and textbooks the system of the differentiation of general laboratory tests is not planned.

2. The students' individual abilities, their special type of teaching, their grounds are not taken into consideration when they are given the general laboratory tests.

3. The freedom of choice of this or that activity is not put into practice. It means that self-realization which is peculiar to senior students is not satisfied.

4. The process of the developments of experimental skills and habits of senior students is not so rapid as it must be.

We outline some ways to overcome the shortcomings mentioned above. It is necessary:

1. To work out the system of laboratory tests on physics for school students of various specialties (biology, chemistry, and others but not physics trends)
2. To improve the methods of carrying out laboratory tests on the base of the level of differentiation.

The main didactic principles of the creation of our methodological system of general laboratory tests are the following:

- The contents of the educational system is to correspond to the level of modern science and production in all its elements and at all levels
- The contents and the process of training is to be taken into account in the development of the contents of the teaching material
- The structural unity of the contents of the training system is to be followed at the various levels of its development and individual progress of students is to be taken into account.

Trying to satisfy these didactic principles we established the relations between the process of training physics and process of its individualization and differentiation, defined the field of the execution of these processes and found the correspondence of the levels of the differentiation with the contents of laboratory tests.

We defined what elements of knowledge must be revealed I laboratory tests. Of course, basic knowledge on physics is defined by the Federal Component of Education Standard on physics. The contents of knowledge for the advanced study on physics are defined by the Regional Educational Standard and by authors' experimental curricula.

These curricula show interrelations between physics and other exact sciences studied at school.

The total knowledge on physics is the certain combination of basic, advanced and expanded knowledge.

We defined concretely skills and habits which are to be developed at each concrete level of training of the system of differential laboratory tests.

We distinguished the basic level of skills and habits compulsory for all school students.

A student is to be able:

1. to understand and base theoretically the chosen variant of the experiment (to understand the purpose of the experiment, to hypothesize and base the hypothesis);

2. to plan the experiment (to determine the technique of the experiment and to make a plan of its carrying out, to choose the proper devices for it, to install the equipment and prepare it for the experiment);

3. to take measurements (to use special devices, to follow the rules of its operation, to define the scale, to define the limits of the measurement of the scale, take readings and find errors);

4. to observe and reproduce the phenomena of physics (to describe and explain the events and processes of the experiment);

5. to process and draw up the results of the experiment (to write values properly, to calculate errors, to make up table, to draw graphs);

6. to make conclusions.

Having studied some authors' curricula, some curricula on special training on physics, the Regional Component of the Educational Standard on physics we chose the following experimental skills of the advanced and expanded levels of teaching.

Skills of advanced level:

7. to define the absolute and relative error in the results of the measurements obtained in the course of the experiment;

8. to be able to use knowledge of other subjects and skills obtained in the course of the experiment

9. to define the limits of applicability of phenomena, processes, theories.

Skills of the expanded level:

10. to be able to work with special objects(biological, primary sources, computer patterns and others), to use special methods of study related to the main subjects by school students;

11. to be able to use independently various sources of information(to find the necessary facts and information in various books and papers, Russian and foreign, to be able to use foreign sources, in the language which the students study, write a report, summary, review, give a reference on research work in Russian and if possible in a foreign language);

12. to be able to submit the results of the experimental research(to put the results of the research in order to argue, persist in their opinion, to read the paper at the seminars, conferences. If possible they may take part in the international events and do it in a foreign language).

The skills described above are the skills of a higher level. On the base of this consideration we worked out general laboratory tests for classes of biology, geography, chemistry and other specialties. The special teaching appliances were published.

The level of differentiation in the organization of training is the organization of training when students are taught according to the same curriculum but may choose the level of their learning but not lower than the basic one.

The level of the development of skills and habits even those students who are taught by the same curriculum is different/ It means that for the future development of experimental skills individual abilities of each student must be taken into consideration.

Proceeding from these requirements we suggest three variants of general laboratory tests.

The first variant is meant for students with the low level of development of experimental skills and habits. Here the method of reproduction is used (typical situation). The students carry out all steps of the laboratory tests from the definition of the problem to the processing of the result under the direct guidance of a teacher.

In the second variant a student is to use the obtained knowledge and skills in practice. So he must choose the proper equipment for the experiment. Students put forward a hypothesis and discuss the plan of the experiment under the teacher's guidance, other operations are carried out independently.

The third variant includes non-typical situation which is to be carried out by means of the research method. The necessary conditions for the successful execution of this variant are the follows: students' complete independence in carrying out the experiment, non-typical (non-standard) thinking, the high level of practical skills and habits.

The teacher must not make students chose this or that variant but sometimes some students overestimate their powers. For this case the set of patterns was worked out, they are classified as "cold", "warm" and "hot".

A.V. Usova and A.L. Bobov worked out the plan of carrying out an experiment for the 10th grade (full) and for the 11th grade (reduced). This plan is often offered to students for use.

If a student chooses the first variant and cannot find errors in the measurements it is considered the basic level. If a student carries out the first variant and succeeds in finding errors in the measurements or succeeds in solving the task of the second variant of the experiments it is an advanced level. If a student is successive in making the third variant of the experiment it is the expanded level.

In estimating laboratory tasks we rely on the analysis of laboratory tasks suggested by Z.V Sichevskaya. It is described in our recommendations.

Classes last two hours. At the end the obtained results of the experiment are discussed.

It is emphasized that if the hypothesis is formulated correctly the results obtained is various technical appliances confirm it.

Although the preparation of a teacher who uses this method is very labor-consuming but it is the method that provides the development of students' abilities, their experimental skills and habits, improves the level of their knowledge and possibility to use it in practice. The laboratory classes with the use of general laboratory tests of various levels develop the habits of experimentation of students, stimulate the development of their cognitive interests and the process of learning.

More than 500 students from secondary schools of Tyumen and the Tyumen region took part in the experiment on the efficiency of the differential laboratory tests.

As a criterion of the estimation of the efficiency the factors of the method of analysis suggested by A.V. Usova was accepted. Using these factors we can define the completeness of activity, the progress in the development of the experimental skills of a student and the efficiency of the proposed methods.

The results of the experiment were statistically processed by using the method hi-square. It confirms the validity of these conclusions. The theoretico-experimental research gives the opportunity to solve the suggested problems and obtain the following results:

1. On the base of the analysis of the methodical literature and scientific papers the significance, place and function of general laboratory tests in the process of training physics of senior students were defined.

2. The contents and structure of laboratory tests on the base of level were worked out namely:

a) The technology of level differentiation to general laboratory tests of various complication was applied and variants were collected

b) The plans of the lessons and types of students' and teacher's activity were developed

c) The methodical recommendations for the application of laboratory tests of various level were developed

3. The training appliances with the description of the contents and methods of carrying out laboratory tests for students of biology and chemistry, geography and humanities were worked out.

4. We mark the positive influence of the differentiation of the laboratory tests on the development of experimental skills of senior students.

5. The experiment shows the efficiency of the proposed methodical system which now used in some schools of Tyumen (4, 16, 17) and Tyumen region (Chervishevskaya secondary school).

To sum up it may be concluded the following:

The use of the method of differentiation at training experiment on physics, namely, in carrying out general laboratory tests makes the process of training more effective because:

1. The individual abilities of each student is taken into consideration

2. Creative abilities of a student are more stimulated

3. The opportunity to encourage students is realized because a student is free in choosing the variant of a laboratory test.

4. The interest to the future profession is developed as their main subjects are taken into consideration.

5. The base of the further development of students is created in the chosen field of their future activity.

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