Volume 1, Issue 9, December 2023 **ISSN (E):** 2938-3757

DEVELOPMENT OF STUDENTS' LEARNING AND RESEARCH SKILLS ON THE BASIS OF PHYSICAL EXPERIMENTS

Kusharbay Tashbayevich Suyarov
Doctor of Pedagogical and Philosophical Sciences, Associate Professor
Chirchik State Pedagogical University The Republic of Uzbekistan,
E-mail: suyarov.k@cspi.uz

Abstract
This article deals with the methods of teaching physics on the basis of physical experiments. The models of the methodological system for the development of teaching and research skills of general education school students are given, and the results of the experiments are also presented.

Keywords: Educational-research work, educational-research skills, creative thinking, methodological system, physical experiment.

РАЗВИТИЕ УЧЕБНО-ИССЛЕДОВАТЕЛЬСКИХ УМЕНИЙ У УЧАЩИХСЯ НА ОСНОВЕ ФИЗИЧЕСКИХ ЭКСПЕРЕМЕНТОВ

Кушарбай Ташбаевич Суяров
доктор педагогико-филосовских наук,доцент
Чирчикский государственный педагогический университет
Республика Узбекистан,
E-mail: suyarov.k@cspi.uz

Аннотация:
В данной статье рассматриваются методы обучения физике на основе физических экспериментов. Приводятся модели методической системы развития учебно-исследовательских умений учащихся общеобразовательных школ, а также приводятся результаты проведенных экспериментов.

Ключевые слова: учебно-исследовательская работа, учебно-исследовательские умения, творческого мышления, методическая система, физический эксперимент.

Introduction

In the context of the development of world education, changes in scientific knowledge and its paradigms, exact sciences, in particular the subject "Physics", are considered as a multifactorial phenomenon that influences the development of an individual's intellectual potential. The widespread use of methods of mathematical calculation and information and communication

technologies, interdisciplinary scientific research, the complication of the technical, physical experimental base, the globalization of current fundamental problems (for example, the Large Hadron Collider) in research work in physics require the training of modern competent researchers working in collaboration.

As an important factor in the formation of an information and educational environment that promotes the development of creative abilities of the individual on a global scale, it is necessary to improve modern didactic means, forms and methodology for preparing, organizing and conducting physical experiments aimed at developing activity, research, creativity, and research abilities of students . At the same time, the issues of applying interactive education methods in teaching physics, integrating traditional and modern methods of teaching physics, and completing information and communication technologies are becoming more relevant; gradual improvement of the technology of educational and research skills of students.

The degree of knowledge of the problem.

In our republic, in the countries of the commonwealth and in foreign countries, a number of research projects have been carried out to improve the education system and increase the creative abilities of students.

The following research works were carried out by Russian scientists: V.G. Razumovsky - on the development of students' creative abilities, A.V. Usova - on the formation of scientific concepts among students in the learning process A.I. Savenkov - on the development of research ability in students, A.V. Leontovich – conceptual foundations for modeling students' research activities, A.M. Matyushkin - on the importance of creative research activities in education, A.N. Poddyakov - on the methodological foundations of the development of educational and research activities.

Methods

The basis for the development of a methodological system of educational and research skills in students of secondary schools on the basis of physical experiments is the need for competent compilation of the components of this system, the organization of an optional course on the development of educational and research skills in students on the basis of physical experiments and the development of its curriculum and curriculum for the use of mathematical models and programs of modern information and communication technologies when carrying out educational and research work, as well as the determination of criteria for assessing the development of educational and research skills in students.

When creating a methodology for a methodological system for developing educational and research skills in students, the following points can be highlighted: elements of the process of developing educational and research skills in students; objects of the process of developing educational and research skills in students; modern pedagogical technologies in the process of developing educational and research skills in students; predicting the level of development of students' educational and research skills. For this purpose, a model of a methodological system for the development of educational and research skills in students was created, shown in Fig. 1. Specifying the tasks of the component part of the methodological system, we can distinguish such components as target, content and procedural. The target element of the process of

Web of Technology: Multidimensional Research Journal
webofjournals.com/index.php/4

developing educational and research skills in students is aimed at solving the following tasks: identifying students interested in educational and research work, conducting a physical experiment, and involving them in educational and research activities based on an integrated approach to developing educational and research skills.

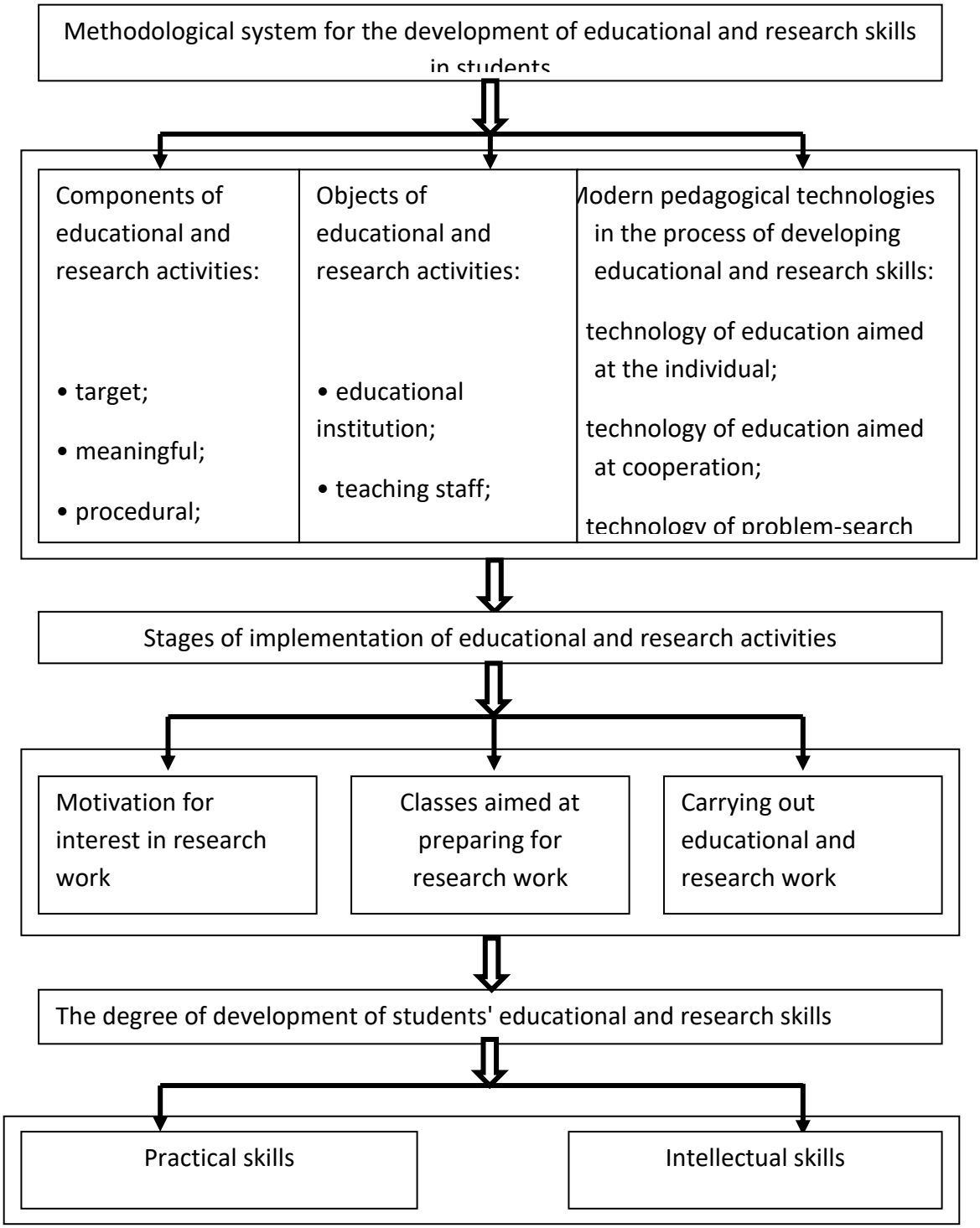

Figure 1. Model of a methodological system for developing educational and research skills in students

Web of Technology: Multidimensional Research Journal
webofjournals.com/index.php/4

The content element of the process of developing educational and research skills in students is aimed at solving the following problems: compliance of educational and research work performed outside the classroom, aimed at developing educational and research skills, with theoretical knowledge, practical exercises, and the content of laboratory work studied during the learning process; material support of an educational institution when choosing topics for educational and research work, take into account the possibilities of carrying out educational and research work by a student of an academic lyceum; compliance of didactic support developed in accordance with the content of the methodological system.

The procedural element of the process of developing educational and research skills in students consists of the following: mastering the elements of educational and research activities in the use of methods of scientific knowledge, physical experiment and its types, analysis and synthesis, educational and research work, research hypothesis, research method; the process of developing skills to work with information; the process of developing creative thinking, as the ability to apply basic knowledge acquired when performing experimental tasks; familiarization with the basic principles of research work, drawing up a work plan for research work, determining the instruments necessary for the experiment, familiarizing with the method of conducting the experiment, conducting the experiment independently; developing the ability to write a report on educational and research work; developing the ability to present educational and research work using mathematical models and ICT programs at work, the ability to use ICT tools during a presentation.

The forecasting component of the methodological system is based on the following criteria: attitude towards educational and research activities (cognitive - knowledge of working with the information received, the sequence of the experiment and the organization of work); motivational (interest in conducting research and understanding the essence of the phenomenon); mastering the methods of scientific knowledge (scientific abstraction, idealization, mental models, putting forward scientific ideas and hypotheses, observation, conducting experiments, presenting results obtained on the basis of scientific facts, measurement, calculation, generalization, analysis, synthesis, conclusions); mastering research concepts (research problem, research idea, research method); attitude towards obtaining data on research work (from various educational literature, reference books and

Results

Considering the teaching method used, the material and technical support of the educational institutions in which the experiment was carried out was studied.

Internet systems); development of the level of creative thinking (thought experiment, convergent, divergent, critical, creative); qualitative characteristics of the level of empirical knowledge of students based on solving problems experimentally (activity, creativity); the process of conducting an experiment (designing an experiment, obtaining results); the level of processing of the obtained results and the use of ICT and mathematical models.

Topics for educational and research work have been developed based on the material security of educational institutions. The factors influencing the educational and research activities of students were studied. A methodology for carrying out educational and research work has been

Web of Technology: Multidimensional Research Journal
webofjournals.com/index.php/4

developed. The assessed composition (practical and intellectual) of students' educational and research skills has been determined. Based on the results of students solving problems of a creative nature, the levels of their convergent and divergent thinking were studied (out of 476 students at the beginning of the observation, 16.4% were convergent, 4.8% were divergent; at the end of the observation, 33.4% were convergent, 11.9% were divergent). Based on the students' solutions to experimental problems, the presence of research activity and the dynamics of changes were established (Table 1).

1-table Results of studying the levels of convergent and divergent thinking of students

Level of thinking	Out of 476 students	
	at the beginning of the experiment	at the end of the experiment
Convergent	78	159
Divergent	23	57

When determining the assessed structure (practical and intellectual) of students' research skills, at the third stage, the stage of determining the development of students' educational and research skills on the basis of physical experiments was completed. A mathematical and statistical analysis of the experimental work was carried out and the results were summarized. The indicators of assimilation of the control and experimental groups are shown in Table. 2.

Table. 2.

Indicators of mastery of control and experimental groups

Умения	**Опытная группа (255 учащихся)**				**Контрольная группа (249 учащихся)**				
	Время опыта	Q_{11} высо-кий	Q_{12} средний	Q_{13} низ-кий	Время опыта	Q_{21} высо-кий	Q_{22} сред-ний	Q_{23} низ-кий	**T**
Практи-ческие	В начале	16	58	181	В начале	13	59	177	
	В конце	29	109	117	В конце	16	82	151	**11,82**
Интеллек-туальные	В начале	11	34	210	В начале	9	34	206	
	В конце	**19**	**67**	**169**	**В конце**	**11**	**41**	**197**	**10,46**

In the statistical analysis of the pedagogical experimental work carried out, the method was applied to them. χ^2- statistics. These hypotheses are tested based on the formula $T = \frac{1}{n_1 n_2} \sum_{i=1}^{C} \frac{(n_1 O_{2i} - n_2 O_{1i})^2}{O_{1i} + O_{2i}}$ criteria χ^2- statistics [4]. Because in the research paper there was a class number for the level of freedom ν = 2 и i =1,2,3 (c = 3), and the level of reliable deviation is 0.05, the value was taken $T_{кр}$=5,991, obtained from the table of the coefficient value of the Pearson criterion, it was determined that the value $T_{наб}$, calculated by the Chi-square method, in all cases $T_{кр} < T_{наб}$.

Web of Technology: Multidimensional Research Journal
webofjournals.com/index.php/4

Discussion:

Based on the experience of foreign countries, in the process of organizing educational and research activities for students, the following modern pedagogical technologies, widely used in developed countries (England, Germany, South Korea, Russia, etc.) were used - information development technology (cognitive, “related” to knowledge"); learning technology based on collaboration activities, learning technology aimed at the individual, developing problem-search technology. These educational technologies have a positive effect on students’ motivation for educational and research work, search activity, cognitive and creative qualities. The objects of the process of developing students' educational and research skills consist of the following components: cooperation between teacher and student, material and technical support of the educational institution, methodological support of the educational institution. The process of conducting an elective course is also considered a procedural component of the methodological system, i.e. During the lesson, the teacher constantly monitors the development of students’ educational and research skills.

When implementing in practice a methodological system for developing students’ educational and research skills, an elective course “fulfills the task of the main tool. Through this course, tasks such as awakening the motive for educational and research work in students are accomplished; preparing students to carry out educational and research work and developing their educational and research skills; definition of educational and research work based on the principle from simple to complex, gradual development of educational and research skills in students.

CONCLUSION

To increase the effectiveness of teaching in secondary schools, the need to introduce into practice a methodological system for developing educational and research skills in students through the optional course “Development of educational and research skills in students based on physical experiments” is justified.

Through physical experiments based on the use of educational technologies aimed at the individual, it was determined that involving students in research activities, the stages of their preparation for carrying out educational and research work and developing their research skills are an effective method for developing educational and research skills in students.

It has been determined that the development of educational and research skills in students is based on the principles of consistency, interdisciplinary integration, creative activity and evaluation of their activities.

REFERENCES:

1. Razumovsky V.G. Development of students' creative abilities in the process of teaching physics. Manual for teachers. - M.: “Enlightenment”, 1975. □ 272 p.

2. Savenkov A.I. Research teaching and design in modern education // Research work of schoolchildren. –M., 2004. - No. 1. – P. 22 – 32.

3. Leontovich A.V. Conceptual foundations for modeling students' research activities // School technologies. 2006. - No. 5. - P.63-71.
4. Poddyakov A.N. Methodological foundations for the study and development of research activities // School technologies. 2006. No. 3. - P.51-58
5. Sangirova Z.B. "Tabiy fanlar" fanini ўqitishda STEM talimi // Science end innovation, 2022. – No. 4. – P.343-349.
6. Joraev M. Methods of teaching physics - Toshkent, "Abu matbuot-konsalt", 2015. – 280 p.

Web of Technology: Multidimensional Research Journal
webofjournals.com/index.php/4