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Didactic Conditions of Implementation of ICT in the Formation of Creativity of Future Teachers of Physics

Sherzod Zhumadullaevich Ramankulov[1], Malik Zhupanbekuly Sultanbek[1], Kamalbek Meirbekovich Berkimbaev[1], Gulmira Pernebekovna Meirbekova[1], Sagidulla Saginaevish Ussenov[1], Meiramkul Zhasuzakovna Zhasuzakova[1] & Nurdaulet Atenovich Shektibayev[1]

[1] Khoja Ahmet Yassawi Kazakh-Turkish International University, Turkestan, Kazakhstan

Correspondence: Sherzod Zhumadullaevich Ramankulov, Khoja Ahmet Yassawi Kazakh-Turkish International University, 161200, Sattarhanov street, 29, Turkestan, Kazakhstan. E-mail: rector.iktu.kz; sherzod.ramankulov@iktu.kz

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Abstract

The priority of education development at the present time due to technological progress and global technologization of advanced countries. The level of modern production, science and technology and social transformation define the public interest in the preparation of competitive, highly skilled, intelligent and proactive specialist with a strong creative mind.

For the formation of a modern specialist is able to master and new production, and technology, and accumulating the advanced achievements of scientific thought in the first place, there should be a qualitative change in the training of students, focusing it on modern achievements of science and technology, an understanding of the basic disciplines, the development of creative and organizational skills of future specialists. It is also important to educate the need to independently acquire knowledge not only in the University but also throughout life.

We revealed a system of didactic conditions of development of creative personality in the cognitive activity of future teachers of physics on the basis of which the participants of the pedagogical process can achieve the desired results.

Keywords: didactic conditions, information technologies, creativity, future teachers of physics

1. Introduction

Physics has always contained a lot of the concepts are quite complex, difficult to understand. The rapid pace of development of science leads to the fact that the number of such concepts, facts, ideas and patterns is increasing. For the concept of organically into scientific baggage of the students so that they can creatively use and develop in the following practical activities, requires great efforts and continuous improvement of a technique of teaching of physics course (Amiraliev, 2003).

Many modern researchers (Goldberg et al., 2010; Thompson et al., 2011; Otero et al., 2010; Eylon & Bagno, 2006) indicate in their work achievements and trends in the development of theory and methods of teaching physics.

Another study of American and Russian teachers dedicated to the development and assimilation of key concepts picture of the world in the process of learning physics and the problem of misconception and formalism in knowledge: D. E. Denisov, I. E. Irodov, N. In. Leonova, L. McDermott, D. R. Sokoloff, R. K. Thornton, I. A. Halloun, D. Hestenes, Andrei khadanovich, F. S. Shifrin, etc. (Sergienko & Alexander, 2009)

Psycho-pedagogical science has developed a solid base the problem of development of creative personality of the teacher. On the one hand, there are works devoted to the development of conceptual and terminology of creativity as a phenomenon to a description of the types and procedural features of creative activity and its psychological mechanisms, etc. (Leonard & Swap, 2010; Lee & Kim, 2010).

Despite the various theoretical descriptions in the literature of the preparation of future teachers of physics for teaching creativity and experience of their practical solutions, emerging trends in the development of society, science and education have highlighted them in new faces and thereby has increased the problem and demanded

rethinking it from the point of view of creating conditions for the enrichment of individual creative personality experience to the maximum extent possible.

The problem of undergraduate education in the field of "Physics" in teacher training institutions with an orientation on the one hand, at improving the scientific and methodological training of the future specialist in the field of physics, on the other hand, focused on the widespread use of ICT in teaching, management of educational process, is relevant.

2. The Main Part of the Research

Information technology tools have a fairly wide range. Greatest opportunities, perhaps, has an active and friendly dialogue in computer-based learning environment. So, methodically researched context sensitive help allows you to create motivational component of the learning process.

Didactic tools of computer support also varied. It's not just computer simulations in need phenomena, but also the implementation of didactic functions ensures the visibility, information and controls.
Informatization is considered as a necessary condition and an important stage involving all the main directions of reforming the system of education in Kazakhstan.

Recently the most reliable methodological guideline in theory individual advancement system approach, which allows us to identify natural connections and relationships of any of the studied phenomenon. We believe that the solution to the problem of development of creative cognitive independence of students can only be carried out on a systematic basis.

The problem before us is also based on a systems approach. This is a system of didactic conditions of development of creative personality in the cognitive activity of future teachers of physics on the basis of which the participants of the pedagogical process can achieve the desired results. When designing a system of didactic conditions of development of creative personality in the cognitive activity of future teachers of physics on the basis of ICT use, we relied on a holistic view of teaching process.

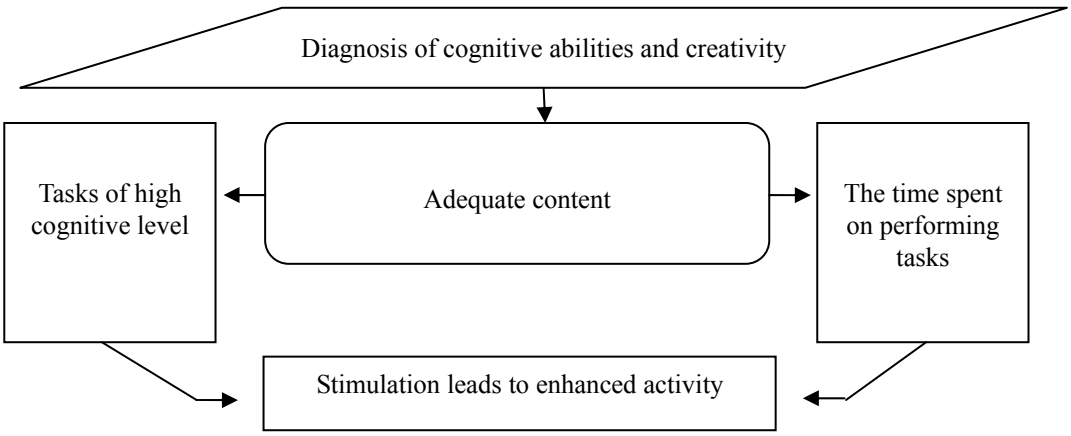

Figure 1. The system of didactic conditions formation of creativity of future teachers of physics

Cognitive activity; reliance on past experience; the development of thinking and speech culture; individualized and differentiated work in the classroom and in the self-study process; the content of the program material; the use of problem tasks; pedagogical skill of the teacher; a variety of creative and targeting tasks; Free promotion in the study.

These conditions formed the basis of the experimental techniques and the formation of creativity of future teachers through the use of ICT in the study of general physics.

When developing the content of courses in ICT, we relied on a systematic approach that not only recognized the need to learn the specifics of any discipline, but is determined by its place in the system of other disciplines, which is an essential prerequisite of successful activity of the creative personality, develop their creative thinking and overall creativity.

In this case, we mean that the cognitive model should reflect the actual learning process and to be adequate to the goal of the development of creative independence.

- A critical rethinking of the courses, the definition of the measure of the intensity of the program material, contributing to the development of creative potential on the basis of information and communication technologies.

- Specialization courses in relation to the preference of the students physicists.

- Development of methods of training for developing interactive creative thinking and independence of students.

An important condition for the formation of creativity of future teachers of physics in the study of disciplines in physics in technicalities is the quality and quantity of creative tasks.

Table1. Conditions for the tasks in the learning process

Tasks -	Should be comprehensive, with sufficient volume, which excludes the probability of non-self-execution.
	For group work needs to unite on the basis of the source of the problem and only then be shared on a strictly individual.
	Should be of interest, search activity and at the same time responsible for the quality of their performance.
	Should cover the maximum number of teaching courses.
	Should include the elements of scientific research.
	Should ensure that the practical implementation of creative ideas (graphical schematic fixation of results, etc.)

There are some examples of such tasks:

Creative tasks. This kind of tasks requires students to have a high cognitive activity and directly refer to the additional literature. We used the following types of creative tasks:

- Cognitive and non-standard tasks, which may have one correct answer for different solutions.

- Experimental research and design tasks.

- Tasks for the conversion and design of experiments.

- Tasks developing logical and combinatorial abilities, involving the search of the unknown by using analysis-by-synthesis.

- Special tasks requiring a non-standard logical approach in addition to the knowledge of the subject (Ramankulov et al., 2015).

In the seminars, we use creative tasks requiring students to have a high cognitive activity and directly refer to the additional literature. In order to enhance the students' creativity, we have developed a workbook for students' self-study on optics with creative tasks. This workbook contains the following types of creative tasks: crosswords; tasks based on an experiment; tests of different types.

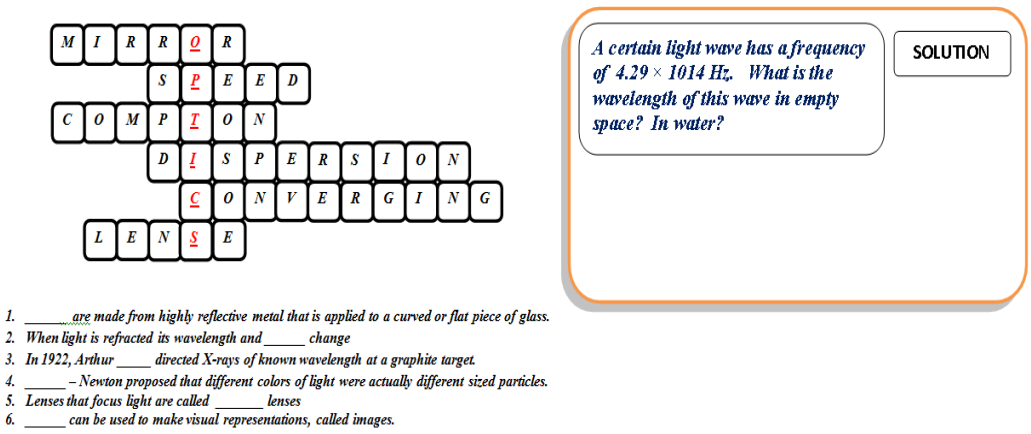

Figure 2. One of the pages of the workbook used at optics seminars (Ramankulov, 2015. Optics Workbook)

3. Setting Up the Problematic Experiment

In the study of optics the experiment performs its heuristic, correcting, summarizing and research functions.

Therefore, on general workshops we use a problematic experiment, based on the creativity of its implementation. Problematic nature of the experiment makes it possible not only to establish new facts, but also to correct errors in students' knowledge, clarify and correct understanding of certain issues of the physics course. The implementation of laboratory experiments on the instructions greatly reduces the degree of independence of students and makes it difficult to take into account their individual characteristics.

At the Physics Department they installed a complete interactive physics course called "Open Physics", which includes more than 80 virtual laboratory complexes, videos of experiments, sound explanations. They provide options for changes of initial parameters and conditions of the experiments, varying their time scale, as well as simulations of situations that cannot be simulated in real experiments (Berkimbaev et al., 2013).

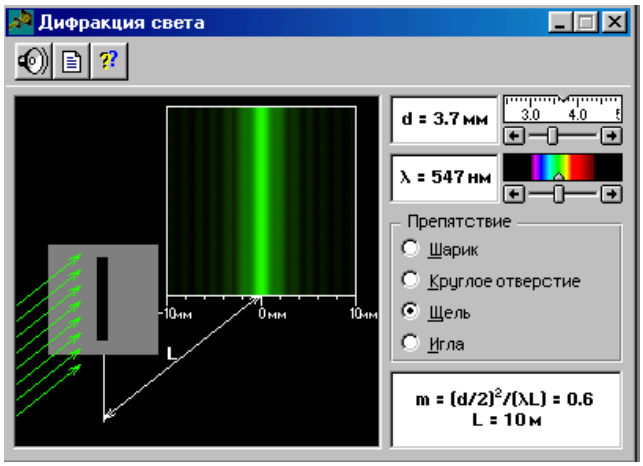

Figure 3. The fragment of the virtual laboratory work "Diffraction of light"

3.1 Problematic Issues

The problematic situation occurs when students are encouraged to search for new knowledge, when there is a need to explain the observed experimental facts with the known theoretical propositions.

First, the students do know neither the original data nor the results. In this case, knowledge is derived from specially designed experiments and logical reasoning of teachers and students. During the conversation a new concept or a proposition is made, the conclusion is drawn. In this case the learning objective is creative in nature. To create a problematic situation in the study of the section "Light quanta" the following questions can be asked:

a) Why are photographs developed using the red light?

Answer: The red light does not affect the photo plate due to the low energy of photons of this light, $\varepsilon = h\nu$,where the frequency ν is low.

b) Does the light produce more pressure on the white or black surface?

Answer: Bouncing off the white surface, the light produces the pressure equal to $p = 2I / c$. The light is not reflected off the black surface, in this case the pressure is equal to $p = I / c$. This shows that the light rays produce more pressure on the white surface.

Formulation of such a task is quite justified, because the students have a great store of knowledge in optics. However, the lack of knowledge on the issue raised makes its decision alternative. Students make both positive and negative assumptions.

3.2 The Use of Didactic Fairy Tales and Poems

One of the most interesting and promising techniques for the development of creative qualities of students in the study of optics is the use of didactic fairy tales and poems. Those poems and fairy tales can be didactic that are written or chosen for using in the learning process and contain the information on the subject

(Zinkevich-Evstigneeva & Grabenko, 2003). In their use it is important to correctly motivate a student to search for new ideas and, as a result, to write a fairy tale or a poem.

Didactic fairy tales in the study of optics shall allow to cover any of subjects, so the theoretical part, necessary for learning, is repeatedly read, analyzed, combined, compared by a student and only then it turns into a fairy tale. The use of such a technique is also useful due to the fact that even the backward student's show great interest, and sometimes their work outperform the work of the other students. At the beginning of the first lesson, students must provide an algorithm of writing stories, which will consist of the following:

- The introduction containing the information on the subject under study.

- Optical processes and phenomena.

- Appeal to the student. This is a final stage when it is necessary to find a solution to the situation.

For example: Reflection of light, its refraction,

Rectilinear propagation, Imaging, these are all the issues that OPTICS considers.

3.3 Creating Situations That Are Close to the Practice

By this we mean the creation of such a learning environment in which the examples and assignments are directly related to the daily life of each student. For example, in the study of the light interference students are offered to study it on the example of the light interference observed in vivo, rainbow coloring of thin films (soap bubbles, oil spill, and transparent oxide films on surfaces of hardened metal parts of annealing color) can illustrate this process. The formation of partially coherent waves interfering during application occurs in this case due to the reflection of light falling on the film from its upper and lower surfaces. The result of interference depends on the phase shift acquired by overlapping waves in the film and depending on their optical path difference.

This formulation of tasks requires students to have a high cognitive activity and directly refer to the additional literature. Such situations contribute to the development of communicative and organizational pedagogic abilities and the development of creativity (Berkimbaev et al., 2015).

4. Methodology and Materials

In the lecture course explores the various concepts, theoretical basis and practical results of teaching students physics, produced by the system of scientific knowledge on teaching methods, for each topic discussed, the objectives and content of the material physics. Students will learn about the methodical skills, gain the necessary knowledge to carry out practical activities in the formation of pedagogical skills included in the professiogram teachers. Teacher provides General guidance for the process of learning this subject matter.

For the purpose of activation of cognitive activity of students in seminars, it is advisable to conduct classes in the form of discussions of course, to require students scientifically based statements when solving methodological problems, and greater involvement of students to solve common issues related to teaching Informatics in school, and give students the opportunity to decide for themselves. Special challenges for the teacher: he must guide, encourage, encourage students to exchange points of view; to give students the opportunity to make decisions, to analyze them may have different ideas and approaches. Therefore, for the students before the seminar is held consultation on the preparation for the lesson, provides recommendations for the content material, in any form to illuminate studied the question, what books to work, etc.

In methodological training has great value independent work, understand how the work, which clearly shows the originality of thinking, regardless of whether the work gets done with a teacher or without him. We believe the presence of independent work of students one of the most important means of developing the abilities of future teachers to independently produce, process and practically apply knowledge. The result is a limitation explains the functions of the teacher, the transition from descriptive explanations of the evidence, the formation of a special type of thinking - creative thinking.

While independent study students acquire special skills, such as: to methodically analyze and critically

evaluate training material and manuals and to use them creatively; to plan and conduct a simple methodological experiment fragment of the lesson to study for the teacher's questions; select and practically use the scientific literature on the research question; to present the results performed research in the form of a paper, report, and issue, using recommendations for the design of this document; use the results self-research in their practical work on teaching practice. This training is provided during the whole course methodology: in preparation for the workshop, and in the preparation of creative works on the subject, which is the result of methodical training.

The efficiency of absorption of one or another of the content we put in direct dependence on teaching methods.

Table2. Conditions of the learning methods

Each method -	Should include the degree and measure of student self-disclosure;
	Should satisfy the need of the learner to new information;
	Should promote communicative adaptation through improving skills of communication (verbal or written);
	Should assist the trainee in self-expression (creative focus).

We use the following materials which we have developed for the formation of creativity of future teachers of physics (Ramankulov et al., n. d.):

- In the lecture: the electronic textbook "physical processes";

- In the seminar: "problems in physics", "the tasks of a creative nature";

- In the lab: - training programme "Open physics".

5. Results

The analysis of problems of development of creative potential through the use of ICT in the experience of modern higher pedagogical University has allowed to establish that the modern educational process pedagogical University still poorly focused on the specialist training of a new type that combines high professionalism, social maturity and creativity, there is therefore a need to reorient the educational process in the contemporary pedagogical University on specialist new type with strong creative potential through the use of ICT.

The implementation of formation of creativity with the use of ICT was made by performing creative tasks and testing copyright methodological developments. The maximum approximation of formation of creativity of students-physicists to the predicted result at the expense of independent creative jobs.

Assessment activities were organized for timely correction of educational process aimed at the formation of creativity of students-physicists through the use of ICT. The complexity and systematicity of control enabled the experimental analysis of the effectiveness of teaching.

6. Conclusion

The study of formation of creativity of future teachers of physics through the use of ICT in the study of General physics at the pedagogical University included several aspects: the state of the question in the domestic psychological-pedagogical literature, the definition of the essence and specificity of creative potential, analysis of problems in the experience of the modern higher pedagogical education.

Historiographical analysis of the problem of formation of creativity found that she was and is the center of attention of pedagogy and psychology, and with the change of the pedagogical paradigm, with the introduction into the education system of modern means of ICT is directly related to the formation of students, which is an important quality of a person, which implemented its basic needs (self-actualization, self-actualization, self-assertion).

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