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ADVANCING THE METHODOLOGY OF TEACHING BIOLOGICAL SCIENCES BASED ON THE ORGANIZATION OF RESEARCH ACTIVITIES OF STUDENTS

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Abstract

At the present time, the most important task of higher education is its focus on the acquisition of each student's own full-fledged personal experience. In this regard, a number of presidential decrees and orders will be adopted in the coming years, raising the education system to a new, higher level. Special attention is paid to the improvement of teaching methods, the gradual introduction of the principles of individualization of the educational process, the introduction of modern information and communication technologies and innovative projects in the field of higher education. Based on all of the above, going beyond the profile of our activities, as well as the scientific goal, our attention was drawn to the organization of research activities in the teaching of biological sciences. In the work under study, the terminological apparatus of the definition of the concept of "research activity" was given, which is presented by local authors, researchers from CIS countries and foreign authors. In the course of carrying out research activities, projects developed by us were provided, such as: Conducting a laboratory lesson on the topic: Studying the results of crossing cotton, tomato and night beauty plants based on a herbarium; Organizing a study tour on the topic: Studying genetically resistant cotton varieties (Bukhara 6, Porlok); Organizing a school scientific and practical conference on the topic "Hereditary diseases in humans". At the end of the research work, an experimental study monitoring the effectiveness of the organization of research activities in the teaching of biological sciences is presented.

Keywords: *education, pedagogical higher educational institutions, research activities.*

Introduction

Nowadays, the term "modernization of education" has often been used in the Republic of Uzbekistan. The development of the education system and the upbringing of the younger generation is an important direction of modernization of education (Khamdamova M.I., 2022) The improvement of the educational process is now in the direction of increasing active teaching methods that provide deep insight into the essence of the problem being studied, increasing the personal participation of each student and his interest in learning. The development of the student's personality, his intellect, feelings, will is carried out only in active activity. It is necessary to create conditions conducive to the emergence of students' cognitive need to acquire knowledge, to master the ways of using them and influencing the formation of skills and skills of

creative activity. The success of students' research activities is mainly ensured by the correct planning of the types and forms of tasks, the use of effective task systems, as well as the skillful guidance of the teacher in this activity (Anisimova, V.A., 2009).

Literature review

Pedagogical science has recently been considering the educational process in a professional school as a means of forming students' readiness for research activities in unity with the development of personality, and the scientific activity of students is called one of the priority directions for the development of innovative processes in the system of professional pedagogical education abroad (Radionova, S.A., 2009). Next, we will consider a literary review of the concept of "research activity" by various authors:

Table 1. The concept of "research activity" by different authors

| | |
|----------------------------|---|
| A.I. Ivanova [3] | the process associated with the selective focus of human attention |
| N.E. Veraksa [10] | motivations for activity |
| N.F. Golovanova [2] | the unity of emotional-volitional and intellectual processes that increase the activity of consciousness and human activity |

| | |
|--|--|
| V.S. Mukhina A.V. Petrovsky [7] | emotional and cognitive attitude of a person to the world, with a motivated state of cognitive character |
| A.N. Poddyakov [8] | a type of activity of a child aimed at finding objective information about the structure of the surrounding world through personal practical experimentation with the object of research |
| Z.A. Mikhailova [6] | the specific attitude of a person to an object caused by the consciousness of his personal significance and emotional attractiveness |
| F.N. Kerlinger [4] | it is a systematic, controlled, empirical and critical study of hypothetical assumptions and permissible natural phenomena. |
| D. Woodhouse [11] | intellectually controlled scientific research, which, through discovery and systematization, leads to the acquisition of knowledge of new information or the development and further awareness of existing information and practice. |

An analysis of the literature has shown that the process of ensuring the unity of scientific and educational training is being activated in European pedagogical higher educational institutions through the wide involvement of students in research and experimental work. For example, in France, Hungary, Germany, not only state and national educational standards indicate the mandatory involvement of students in research work, but also some university departments determine the presence of a completed and defended scientific project as one of the requirements for an applicant (Radionova, S.A., 2009).

Materials and Methods

I would like to emphasize that in order to form students' research skills, the teacher needs to organize research activities in the classroom, in extracurricular and extracurricular activities. The relevance of the research topic is thus determined by:

- low level of use of visibility and technical means of training;
- incomplete and insufficient individualized learning;
- poor organization of independent and research work of students;
- low cognitive ability and activity of students due to the predominance of the classical paradigm of education and one-sided motivation of teaching (Yunusova N. KH., 2016);

Research methods:

- 1) theoretical study of psychological, pedagogical and methodological literature on the problem of research;
- 2) diagnostic: using methods adequate to the purpose and objectives of the study (observation, conversation, questionnaire)
- 3) experimental (implementation of the research activity organization program).

The execution process includes seven stages:

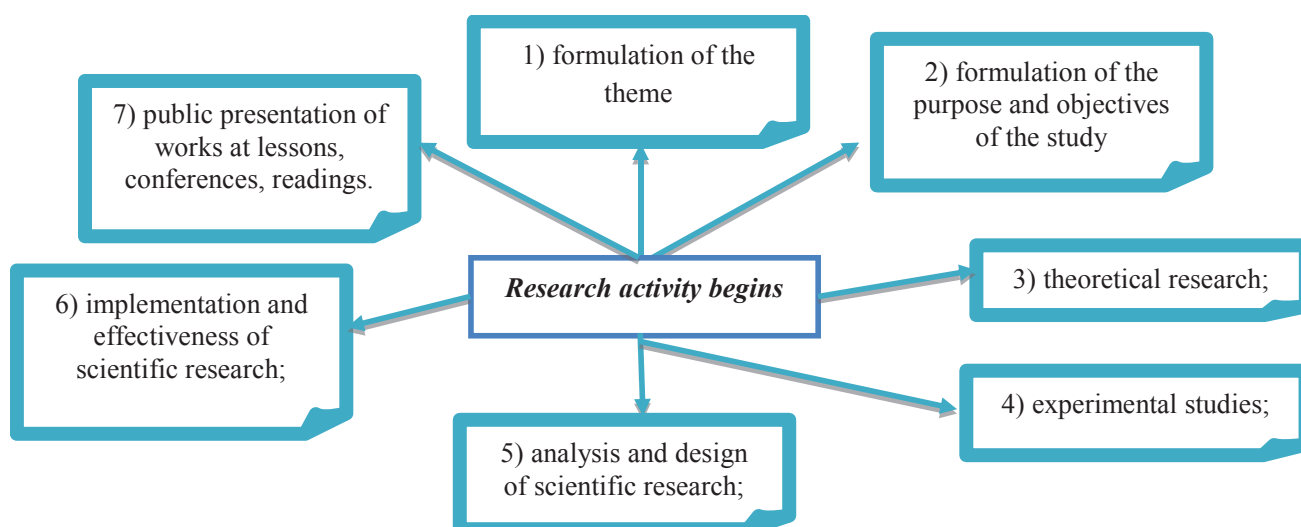


Figure 1. The process of organizing research activities

Results and Discussion

For the effective organization of research activities, close cooperation between the student and the teacher is necessary using various methods and techniques of organizing the research process. Its goal – the education of an educated, harmoniously developed, creative personality, the identification and support of gifted students – is achieved only if the scheduled and extracurricular types of educational and research activities are combined. To this end, we conducted the following experiment, which included the selection of two groups of pedagogical higher educational institutions. The first group was selected as a control group where classes were held as usual without conducting any excursions, conferences, etc.

The second group was selected as a control group, where the following types of research activities were carried out:

Examples of the organization of research activities

I. Organization of research activities in classroom classes

| <i>Plant</i> | <i>Dominant feature</i> | <i>Recessive trait</i> | <i>Intermediate feature</i> |
|--------------|-------------------------|------------------------|-----------------------------|
| Cotton | | | |
| Tomato | | | |
| Night Beauty | | | |

II. Organization of research activities in extra-curricular classes

Organization of a study tour on the topic: The study of genetically resistant varieties of cotton (Bukhara 6, Porlok). The purpose of the excursion: to form knowledge about the best varieties of cotton, to consider varieties Bukhara 6, Porlok, to develop the creative abilities of students.

Objectives of the tour:

- to introduce students to the variety of cotton plants;
- expand and concretize students' knowledge about the importance of cotton in agriculture;
- develop students' initial skills to observe sustainable varieties of cotton.

Place of the tour: Center of Genomics and Bioinformatics of the Academy of Sciences of the Republic of Uzbekistan

Stages of the tour:

The first stage is preparatory, preparation for the project can begin at the lesson that opens a new topic or at the end of studying the topic.

Conducting a laboratory lesson on the topic: Studying the results of crossing cotton, tomato and night beauty plants on the basis of a herbarium.

Purpose: To consolidate students' knowledge about inheritance based on herbarium.

Necessary equipment. Herbariums prepared from various varieties of cotton, tomato and night beauty, cotton fibers of white, brown, red, light beige color, tomato fruits of various shapes and colors.

The order of work. Students are divided into three groups. Each group works on individual plants, reports the results and justifies them.

1. Study herbariums of various varieties of tomato plants. Identify dominant and recessive signs, study the shape of stems, leaves, fruits and compare them with each other.

2. Study herbariums of various varieties of cotton plants. Identify dominant, recessive and intermediate signs. Determine the reason for the different color of the fibers.

3. Study herbariums of night beauty plant varieties with red, white and pink flowers. Compare the stems, leaves and the structure of the flowers. Based on the results of the work, fill in the following table:

Setting the purpose of the excursion (helps to determine the content, ideological and moral orientation of the excursion, contributes to the effective selection and coverage of the material of the future event)

- Selection of content on the topic of the excursion (a list of books, brochures, articles that the student should read is compiled on the topic of the excursion.
- Selection and study of excursion objects (of all objects, the teacher selects the most interesting in appearance and informative content).
- Preparation of the tour route (the route should provide the display of objects necessary for the most complete disclosure of the topic of the tour).

Preparation of students for the excursion (it is necessary to focus their attention on certain objects in advance, explain how to conduct their observation)

The second stage is conducting, the tour usually begins with an introduction to the problem – a story or conversation. Then the teacher explains the purpose and individual tasks for students, determines the place and time of their execution (no more than 20 minutes).

| route | stop | display objects | time (min) | list of questions revealing the topic and subtopics | organizational instructions | methodical instructions |
|-------|------|-----------------|------------|---|-----------------------------|-------------------------|
| | | | | | | |
| | | | | | | |

Students are divided into two groups:

The first group considers the cotton variety Bukhara 6 (external structure, areas that can be planted with this variety of cotton, weight, fiber length, fiber type, root system, etc.)



| | |
|---|------------------|
| height of the main stem | 100-110 sm |
| growing season | 115-120 days |
| bush shape | cylindrical |
| weight of cotton-raw materials of one box | 5.5-8,0 |
| yield | 40-50 c/ha |
| weight of 1 thousand seeds | 140 gr |
| root system | highly developed |
| fiber length | 38-40mm |
| fiber input | 34% |
| fiber type | ii |
| micronair | 3.9-4.2 |
| strength | 36 g.s./tex |
| fiber length, inch | 1.28 |

The second group considers the Porlok cotton variety (external location, areas where this cotton variety can be planted, weight, fiber length, fiber type, root system, etc.)



| | |
|---|------------------|
| height of the main stem | 110-120 sm |
| growing season | 115-120 days |
| bush shape | cone - shaped |
| weight of cotton-raw materials of one box | 6.5-7,0 |
| yield | 45-55 c/ha |
| weight of 1 thousand seeds | 140 gr |
| root system | highly developed |
| fiber length | 37-38mm |
| fiber input | 34% |
| fiber type | ii |
| micronair | 4.3 |
| strength | 36 g.s./tex |
| fiber length, inch | 1.27 |

The third stage is the processing of the materials of the tour and summing up its results. Processing of the results of the excursion is carried out upon returning to school. The results of observations are recorded in a workbook or in observation diaries. The collected natural material is systematized.

III. Organization of research activities in extra-curricular activities

Organization of a school scientific and practical conference on “Hereditary diseases in humans”

Purpose: to form concepts about human genetic and chromosomal diseases, to study the statistics and distribution of genetic and chromosomal diseases, to find out their causes and consequences.

Tasks:

- develop research skills, cognitive and creative abilities in the process of studying hereditary human diseases.

- to deepen knowledge about the genetic patterns of human inheritance.

The effectiveness of the conference increases if the teacher addresses the students with 2/3 control questions after each report.

The conference plan:

1. Medical genetics – as the science of hereditary human diseases:

- tasks of medical genetics;
- methods of medical genetics.

2. Gene diseases:

- mutation;
- manifestation of gene diseases;
- examples of gene diseases.

3. Chromosomal diseases:

- causes of chromosomal diseases;
- medical genetic consultation.

Preparation of the conference.

The topic and time of the conference are reported after the introduction of the concept of gene and chromosomal diseases and their relationship. Explain the tasks of the conference. Report the topics of the reports. Each report is assigned to two students, which facilitates the preparation of a demonstration experiment, diagrams, posters.

Questions to students on reports.

According to the first report.

1. How many hereditary diseases are there in humans?

2. List the main tasks of medical genetics.

3. List the main methods of medical genetics.

On the second report.

1. How do human gene diseases manifest themselves?

2. Is it a mutation?

3. Factors influencing the occurrence of genetic diseases.

On the third report.

1. How do human chromosomal diseases manifest themselves?

2. Factors influencing the occurrence of genetic diseases.

3. How is medical genetic consultation carried out?

The assessment of students’ knowledge was carried out in accordance with criteria that allow identifying three levels of knowledge: high, medium and low.

High level. The task is fully completed, the purpose of the question is achieved, the problem is fully disclosed; the student has a systematic full knowledge of the question; the content of the question is related, in a brief form, reveals the essence of the processes, does not allow biological errors and inaccuracies. A student can apply knowledge to substantiate the laws of wildlife, establish the relationship between the structure of organs and the functions performed by them.

The average level. The task is completed, the goal of communication is achieved. However, the problem is not fully disclosed, because some insignificant elements are missing, minor biological errors are made, the main content of the question is illogically, at length. There are a number of errors.

Low level. The task is partially completed, the purpose of communication is not fully achieved, the topic is disclosed to a limited extent, the student finds it difficult to draw a conclusion on the topic. The student cannot apply knowledge, cannot reveal the essence of the process. In the answers to the proposed control questions, there is a lack of understanding of the individual provisions set out.

Table 2. Results of the control experiment:

| High level | Medium level | Low level | Lowest level |
|------------------------------|------------------------------|------------------------------|-----------------------------|
| 10 out of 25 students 40% | 8 out of 25 students 32 % | 4 out of 25 students 16 % | 3 out of 25 students 12% |

Table 3. Research activities of students:

| Active students | Average active students | Passive students |
|------------------------------|-----------------------------|-----------------------------|
| 14 out of 25 students 56% | 6 out of 25 students 24% | 5 out of 25 students 20% |

Table 2, 3 shows that the initial level of knowledge of students in the control group is low.

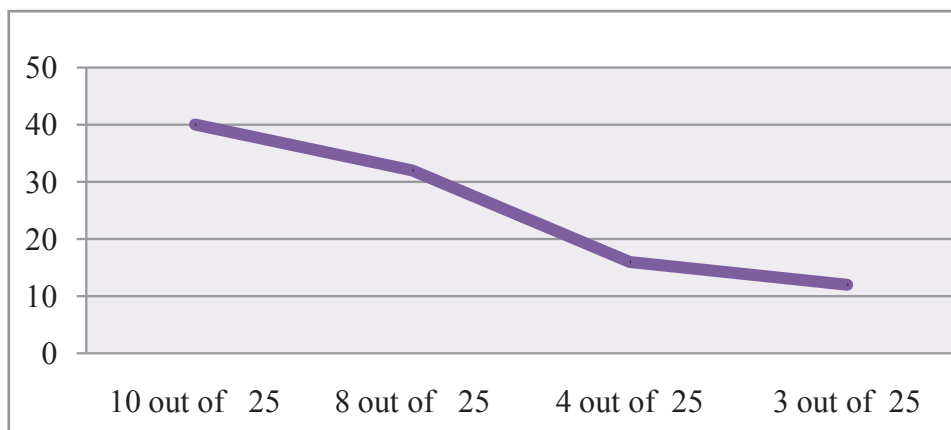


Figure 2. The results of the control experiment in the form of a graph

Figure 2 shows that when using only traditional teaching methods, the academic performance of the control group is low.

Conducting an experiment in an experimental group:

- conducting an excursion on the topic: The study of genetically resistant varieties of cotton (Bukhara 6, Porlok).
- organization of a school scientific and practical conference on the topic “Hereditary diseases in humans”.

Table 4. Results of the organization of students’ research activities:

| High level | Medium level | Low level | Lowest level |
|------------------------------|------------------------------|------------------------------|----------------------------|
| 11 out of 25 students 44% | 8 out of 25 students 32 % | 4 out of 25 students 16 % | 2 out of 25 students 8% |

Academic performance of the experimental group

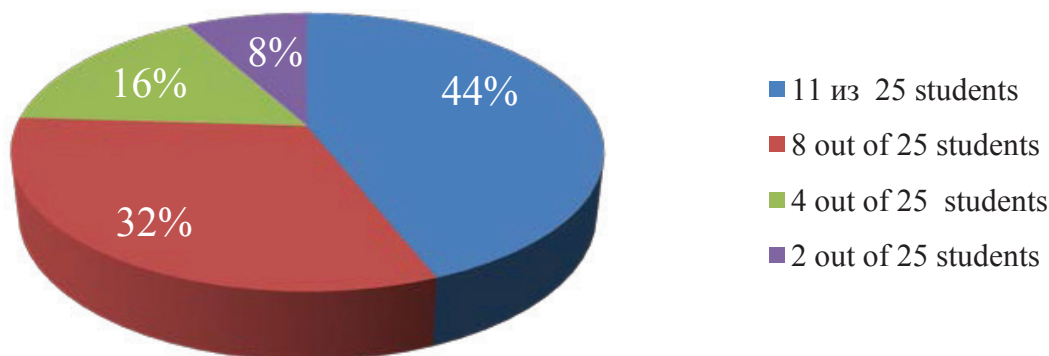


Figure 3. Results of the organization of students’ research activities

Table 4 and Figure 3 show that the initial level of knowledge of students in the experimental group has increased.

Table 3. Research activities of students:

| Active students | Average active students | Passive students |
|------------------------------|-----------------------------|----------------------------|
| 19 out of 25 students 76% | 4 out of 25 students 16% | 2 out of 25 students 8% |

As can be seen from Table 3, the level of knowledge in the students of the experimental group has increased: a high level of knowledge by 20%.

Conclusion

In the course of the work, the literature on the organization of research activities of teachers and students in the lessons of genetics was analyzed and studied.

The use of research methods in teaching biology has shown an increase in interest in the subject, activation of independent cognitive activity.

Through the organization of educational research activities, the principle of individualization and differentiation is implemented, the development of interests, inclinations and abilities of students, basic competencies are formed, stimulates independent cognitive activity, conscious preparation for choosing a future profession, continuing education, taking into account the demand in the labor market. Research activity allows solving simultaneously the issues

of education, development and upbringing of the younger generation. The classes that I conducted, with the help of research activities, caused a great emotional uplift and increased the level of assimilation of the material, stimulated initiative and creative thinking.

I think the organization of research activities is one of the most effective in developing motivation to study biology:

- contributes to the effective assimilation of educational material;
- helps to make the learning process more diverse and exciting, personal - developing;
- allows you to fundamentally expand the capabilities of the teacher in the selection and implementation of teaching tools and methods;
- provides great opportunities for the student to realize creative abilities.

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