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Analysis Of Research, Project Skills, And Abilities In Biology Students: A Case Study Of "Genetics"

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Abstract – This study examines the research, project skills, and abilities of biology students using the subject "Genetics" as a case study. It identifies the didactic potential of the "Genetics" section and its significance in shaping research and project skills while developing the professional competencies of future biology teachers. During the research, methods were used to study and comparative analysis of scientific, pedagogical and methodological literature on the research problem, analysis of regulatory documents, curricula, teaching aids and teaching materials, observation, questioning, testing,

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In the era of globalization, significant attention is paid to education as a country's level of development depends not only on socio-economic factors but also on its intellectual potential. Scientific progress, nurtured within educational environments, plays a central role in the sustainable development and prosperity of a nation. The Incheon Declaration, adopted by the World Education Forum organized by UNESCO and other international organizations before 2030, places special emphasis on improving the quality of education, incorporating mechanisms to enhance the assessment of education quality, and determining achieved outcomes. Its concept revolves around transforming people's lives through education, recognizing the pivotal role of education as the primary driving force of development [10].

In a context where education, particularly the development of the education system, assumes a central role in all transformations in an educated, politically engaged, and socially active society, the development of the education system becomes crucial [11]. It is essential to note that Uzbekistan's education policy is geared toward a phased and systematic implementation of principles outlined in the Constitution of the Republic of Uzbekistan [4].

In the global context, research in the field of genetics holds particular significance. Leading universities worldwide, such as Harvard University (USA), the University of Tokyo (Japan), the University of California (USA), and the Massachusetts Institute of Technology (MIT, USA), conduct scientific research in this domain. Scientific research is a crucial component of higher education, enabling students to engage in research activities. This holds immense value for the professional development of future specialists and influences the quality of teaching, the connection between education and science, and real-life applications.

The "Development Strategy of New Uzbekistan for 2022-2026" places special emphasis on "Improving the quality of education in schools and elevating the international level of knowledge and qualifications of pedagogical personnel" [6] The

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necessity of preparing students for research activities is reflected in the national educational standards and is an integral part of higher professional education.

In foreign countries, new approaches to the development of research activities during the educational process have been analyzed by researchers such as R. Susan, B.J. Barron, M. Schvartz, and others.

However, an analysis of recent research on the effectiveness of students' research activities in preparing future specialists within a university setting suggests that this issue requires further investigation. Despite existing studies related to the formation of research skills during university education, the problem of improving the teaching methodology of the subject "Genetics" through research and project activities for future biology teachers has not been the subject of specific research.

Considering the popularization of genetics, it is important to note its interdisciplinary nature. Genetics is connected to numerous fields, including psychology (studying the influence of heredity on behavioral reactions), medicine (examining hereditary anomalies), chemistry and physics (borrowing research methods and exploring the mechanisms of genetic apparatus, such as gene transmission across generations), philosophy (providing evidence for evolutionary processes), history and archaeology (investigating human migrations, determining the species affiliation of fossil remains), ecology (studying population genetics, preserving gene pools, predicting and preventing adverse human interventions in natural processes), and production (breeding, GMO creation, agricultural product processing technologies), as well as criminology (establishing paternity) [12].

Research activities in education offer significant developmental opportunities by fostering cognitive skills and critical thinking, stimulating interest, and enhancing students' ability to construct knowledge independently while navigating the modern information space.

According to T.G. Belov, research work holds a significant place in students' educational activities [2].

Research skills should be integrated into the professional competencies of educators. Research indicates that the majority of teachers with higher pedagogical education, regardless of their age and years of experience, are not adequately prepared to conduct research activities and often lack the necessary problem-solving skills. Educators face difficulties in organizing the educational process based on research [1, 3, 8].

The explanation for this issue lies in the practice of professional teacher preparation in universities, which does not adequately equip them with the required skills and experience in conducting research activities. Hence, it is crucial to carry out professional rehabilitation in this regard.

Therefore, the new educational standards should be one of the avenues to enhance the level of preparation of professionals with higher education through approaches and techniques that promote individual and collective research work. This, in turn, leads to the development of research independence and, as a result, the formation of highly professional specialists capable of generating new ideas [11].

Knowledge in genetics constitutes a key component of pedagogical university education in the biological field and shapes the biological thinking of students. The complexity of genetics content and the difficulty of comprehending genetic regularities underscore the special role of genetic problems in the assimilation of educational material.

The material resources of many pedagogical universities do not permit the conduct of genetic experiments that illustrate genetic regularities. Consequently, solving genetic problems is deemed an effective approach with positive results in the study of genetics by students [9, 13, 14].

Genetic problems can be characterized by several levels of complexity (Diagram 1).

Problems related to the inheritance of sex-linked traits, determination of chromosomal sets, and the number of alleles in gametes are particularly challenging.

The study of genetics in universities fosters components of biological culture in students, which are of significant professional value. Many researchers have demonstrated that the use of multi-level developmental genetics problems is aimed at building knowledge, skills, competencies, and cognitive development [9].

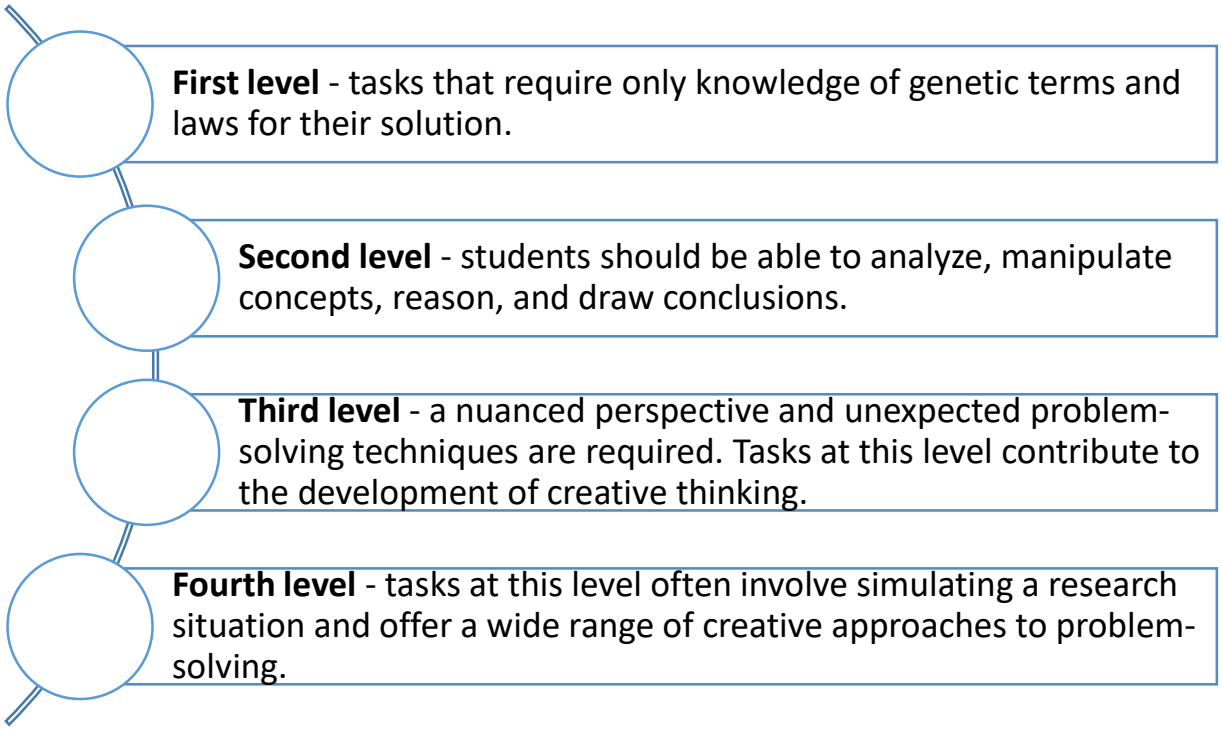

Diagram 1. Levels of complexity of genetic problems.

Given the above, there is a current need for the development of practice-oriented tasks.

Pedagogical institutes and universities play a crucial role in preparing highly qualified personnel. One of the defining vectors in shaping an innovative education model today is biological education [7].

In our Republic, a concept for the development of the higher education system until 2030 has been approved, with the aim of elevating the training of specialists to a new level. This includes:

- The implementation of advanced higher education standards, transitioning from education focused on theoretical knowledge acquisition to education oriented towards practical skills development.

- The gradual introduction of the "University 3.0" concept, fostering collaboration between education, science, and innovation.

- Establishing cooperation between education and research institutes (Scientific-Research Institutes) and industrial enterprises.

- Developing proposals to enhance the quality of higher education, integrating modern pedagogical technologies into the educational process, improving educational programs, and analyzing international experience [5].

Hence, a crucial task of university education is to shape competence and professionalism in future specialists, enabling them to generate ideas and adapt to specific social conditions.

In this regard, the current situation in the training of biology teacher specialists requires a fundamental change in the strategy and tactics of education in pedagogical universities. Solving these tasks necessitates changes and the implementation of new approaches in specialist preparation, utilizing new models of education at the higher education level. The main characteristics of a graduate of a higher educational institution include their competencies, critical thinking, creative abilities, and adaptability. The success and achievement of this goal depend not only on what is learned but also on the quality of learning. This, in turn, serves as a powerful incentive for the development and implementation of new, more effective education models.

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