

ABSTRACT

of the dissertation for the degree of Doctor of Philosophy (PhD) in the specialty 8D01550- "Biology"

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Research theme: «The use of modern bioindication methods for studying woody and shrubby plants as a means of developing research activities of future biology teachers».

The purpose of the research: To theoretically substantiate and use modern bioindication methods for studying woody and shrubby plants as a means of developing the research activities of future biology teachers.

The objectives of research:

1. Analysis of conceptual approaches to organizing research activities of biology students in biological disciplines classes.

2. Development of a methodology for the application of modern bioindication methods for the study of woody and shrubby plants in the educational and research work of biology students.

3. Experimental verification of the effectiveness of using bioindication methods in the process of training future biology teachers aimed at developing research competence.

4. Development of recommendations for the integration of bioindication methods into the educational process in biological disciplines classes for students of pedagogical specialties.

Research methods:

- *theoretical*: comparative-contrastive, system analysis, design, scientific forecasting.

- *empirical*: survey and diagnostic method with elements of questionnaires, testing, expert assessment method, bioindication methods of studying plants, assessment and self-assessment, discussions.

- *statistical*: assessment of statistical reliability in processing the results of a pedagogical experiment using Student's t-test.

The main provisions (proven scientific hypotheses and other conclusions that are new knowledge) submitted for defense:

1. Research activities are an important method in teaching biology, contributing to the formation of students' cognitive interest, a deeper understanding of the subject and the development of key skills.

2. The methodology for using bioindication methods for studying trees and shrubs, developed within the framework of the dissertation research, contributes to the development of research and professional competencies in biology students.

3. The introduction of bioindication methods into the educational process of future biology teachers has a positive effect on the development of their professional competencies, including ecological thinking, a critical approach to data assessment and the ability to conduct independent research activities.

4. The developed methodological recommendations for the integration of bioindication into academic classes in biological disciplines allow for the high quality and systematic development of students' research activities.

Description of the main results of the study:

The first task is presented by the study of modern domestic and foreign experience of using similar methods in teaching natural sciences. The solution to this problem is aimed at determining the level of use of objects of living nature of the native land as a means of forming the necessary competencies in biological subjects.

The second task assumed the development of original bioindication methods taking into account the interdisciplinary approach, aimed at studying general biological patterns, including the creation of modern educational and methodological material to ensure the organization of classes in biological disciplines.

The third task was aimed at studying the effectiveness of using the author's methods in the formation of functional literacy of students in matters of biology, as well as assessing the impact of the developed regional methods on the quality of training of biology teachers.

The fourth task consisted of developing recommendations for the introduction and application of bioindication methods in classes on biological disciplines, which included various examples of laboratory and fieldwork aimed at high-quality preparation of students for modern pedagogical practice in educational institutions.

The degree of novelty of the obtained results and conclusions:

The first result is partially new from the standpoint of methodological substantiation of general scientific and scientific approaches to the organization of research activities of students in higher educational institutions.

The second result is important and new, since the study developed relevant proprietary methods aimed at the effective organization of the educational process and high-quality training of future biology teachers. These methods were presented in the teaching aids "Interdisciplinary Workshop on Botany with Elements of Ecology, Evolution and Genetics of Plants" and "Field Practice: Preparation, Implementation, Storage of Material, Knowledge Control", and author's certificates and patents for inventions were obtained.

The novelty of the third result is a pedagogical experiment was conducted to introduce modern bioindication methods for studying woody and shrubby plants into the educational process of future biology teachers. During the experiment, the effectiveness of this approach was proven, and students demonstrated a higher level of research skills, critical thinking and the ability to analyze information. This confirms that the use of bioindication methods for studying plants in the educational process has a positive effect on the formation of students' competencies for effective pedagogical work.

The novelty of the fourth result is recommendations have been developed for the use of bioindication methods for studying plants in biology classes. The developed methodological recommendations for teachers have proven their practical significance and effectiveness. They allow for the effective integration of methods

into the educational process, which contributes to the effective organization of classes aimed at developing research activities in students, which makes their training more modern and in demand.

Compliance with the directions of science development or state programs:

The main idea of the dissertation complies with the Law of the Republic of Kazakhstan on Education: adopted on July 27, 2007, No. 319-III (with amendments and additions as of February 21, 2019); Resolution of the Government of the Republic of Kazakhstan. On approval of the national project "Quality Education "Educated Nation": approved. October 12, 2021, No. 726; State Compulsory Educational Standards of the Republic of Kazakhstan State Compulsory Education Standards of All Levels of Education of the Republic of Kazakhstan: approved. by order of the Minister of Education and Science of the Republic of Kazakhstan dated October 31, 2018, No. 604.

The dissertation work was completed in accordance with the plans of applied research work (R&D) of the Scientific Research Institute of the Ministry of Education and Science of the Republic of Kazakhstan "Grant financing of young scientists under the project "Zhas Galym" for 2023-2025" on the project on the topic "Development of original author's pedagogical technologies for the purpose of using the regional component in classes on biological disciplines in higher educational institutions" (2023-2025, No. AP19174840).

Description of the doctoral student's contribution to the preparation of each publication:

On the topic of the dissertation, 19 scientific papers have been published, including 2 articles in journals included in the Scopus database (1 article - CiteScore percentile equal to 60%, 2 article - CiteScore percentile equal to 23%); 3 articles in publications recommended by the authorized body of the Ministry of Higher Education of the Republic of Kazakhstan; 7 articles in the proceedings of international conferences; 3 patents for invention; 2 author's certificates, 2 teaching aids.

Publication in publications included in the science metric databases Web of Science and Scopus:

1. Original illustrated tasks with photos of regional plants for botanical knowledge control and consolidation, International Journal of Evaluation and Research in Education (IJERE). – 2024 – Vol. 13. – No.5. P. 3202-3210. DOI:<http://doi.org/10.11591/ijere.v13i5.28376>. (co-authored with Tarasovskaya N. Hamzina Sh., Zhumadilov B., Zhumabekova B.) The doctoral student's contribution to the preparation of the publication is 85%.

2. Creating environment for students to make interdisciplinary competences in botany // E3S Web of Conferences. – 2023. – No. 460. – P.1-10. DOI:<https://doi.org/10.1051/e3sconf/202346005009> (co-authored with Tarasovskaya N., Hamzina Sh., Zhumadilov B., Zhumabekova B.). The doctoral student's contribution to the preparation of the publication is 90%.

Publications included in the list of Science and Higher Education Quality Assurance Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan:

1. Development of original pedagogical technologies for the formation of subject competencies of biology students // 3i: intellect, idea, innovation – intelligence, idea, innovation. – 2023. – No. 4. – P.155-164. DOI: https://doi.org/10.52269/22266070_2023_4_155 (co-authored with Isakaev E.M., Tarasovskaya N.E., Khamzina Sh.Sh.). The doctoral student's contribution to the preparation of the publication is 80%.

2. Experience in creating a workbook on botany with elements of ecology and plant evolution // Biological sciences of Kazakhstan. – 2020. - No. 4. – P. 89-104. (co-authored with Tarasovskaya N.E., Zhumadilov B.Z.). The doctoral student's contribution to the preparation of the publication is 80%.

3. Applied and complex tasks on plant morphology with elements of ecology, physiology and evolution // Biological sciences of Kazakhstan. – 2020. - No. 4. – P.105-121. (co-authored with Tarasovskaya N.E., Zhumadilov B.Z.). The doctoral student's contribution to the preparation of the publication is 80%.

Publications in the proceedings of International conferences:

1. Implementation of the regional component in the process of teaching botany to high school students // Bulletin of Psychology and Pedagogy of Altai State University. – 2022. - No. 4. – P. 62-72. (co-authored with Zhumabekova B.K., Kabdolova G.K., Kabbasova M.T.). The doctoral student's contribution to the preparation of the publication is 90%.

2. Elements of evolutionary doctrine in laboratory classes on botany // Collection of scientific papers of participants of the IX International scientific and practical conference "Education and training in modern society: current aspects of theory and practice". Under the general editorship of S.V. Kaznacheev - Novosibirsk, Sibprint Agency. – 2019. – P. 302-309. (co-authored with Tarasovskaya N.E.). The doctoral student's contribution to the preparation of the publication is 75%.

3. Study of the distribution of fruits and seeds in botany classes at school and university // Collection of scientific papers of participants of the IX International scientific and practical conference "Education and training in modern society: current aspects of theory and practice". General editor S.V. Kaznacheev - Novosibirsk, Sibprint Agency. – 2019. – P.280-286. (co-authored with Tarasovskaya N.E.). The doctoral student's contribution to the preparation of the publication is 75%.

4. Study of awareness of adolescent and high school students about regional natural objects // Education and training in modern society: current aspects of theory and practice. Collection of scientific papers of the XIV International scientific and practical conference. General editor B.P. Chernik. Treasurer's readings, No. 1. – Novosibirsk: MSA (ZSO), 2022. – P. 165-169. (co-authored with Ibragimova S.S., Tarasovskaya N.E.). The doctoral student's contribution to the preparation of the publication is 75%.

5. Educational and methodological significance of trees and shrubs in organizing country excursions for students and pupils // Education and training in modern society: current aspects of theory and practice. Collection of scientific papers of the XIV International scientific and practical conference. General editor B.P. Chernik. Treasurer's readings, No. 1. – Novosibirsk: MSA (ZSO), 2022. – P.153-165. (co-authored with Dulamsuren Ch., Tarasovskaya N.E., Gulko I.G.). The doctoral student's contribution to the preparation of the publication is 75%.

6. Prospects for morphophenetic studies of silver birch (*Betula pendula*) in Pavlodar region // Proceedings of the IV International Scientific Conference "Biological Diversity of the Asian Steppes", Kostanay, April 14, 2022 – Kostanay: A. Baitursynov KRU, 2022. – P. 263-267. (co-authored with Tarasovskaya N.E., Zhumadilov B.Z.). The doctoral student's contribution to the preparation of the publication is 75%.

7. Study of morphological features of silver birch in the conditions of Pavlodar // Proceedings of the IV International Scientific Conference "Biological Diversity of the Asian Steppes", Kostanay, April 14, 2022 – Kostanay: A. Baitursynov KRU, 2022. – P. 267-272. (co-authored with Tarasovskaya N.E., Zhumadilov B.Z.). The doctoral student's contribution to the preparation of the publication is 75%.

Received patents for inventions and author's certificates:

1. Patent of the Republic of Kazakhstan for invention No. 35565. Method for rapid drying of herbarium plant specimens. Published on 06.05.2022, Bulletin No. 51, cl. A01N 3/00 (2006.01). - 2 p. (co-authored with Tarasovskaya N.E., Dulamsuren Ch., Zhumadilov B.Z.). The doctoral student's contribution to the preparation of the publication is 70%.

2. Patent of the Republic of Kazakhstan for invention No. 35564. Method for rapid production of a herbarium. Published on 06.05.2022, Bulletin No. 51, cl. A01N 3/00 (2006.01). - 2 p. (co-authored with Tarasovskaya N.E., Dulamsuren Ch., Zhumadilov B.Z.). The doctoral student's contribution to the preparation of the publication is 70%.

3. Patent of the Republic of Kazakhstan for invention No. 36882. Method for rapid drying of plants in laboratory and field conditions. Published on 16.08.2024, Bulletin No. 51, cl. A01N 3/00 (2006.01). - 2 p. (co-authored with Tarasovskaya N.E.). The doctoral student's contribution to the preparation of the publication is 70%.

4. Certificate of entering information into the state register of rights to objects protected by copyright, No. 16069. Illustrated workbooks on botany and evolutionary theory. published on March 19, 2021 (co-authored with N.E. Tarasovskaya). The doctoral student's contribution to the preparation of the publication is 70%.

5. Certificate of entry of information into the state register of rights to objects protected by copyright, No. 18657. Regional component in practical classes on botany and local history (illustrated tasks on ecology, morphology and taxonomy of plants, and knowledge of regional flora). Published on 11.05.2021 (co-authored with Tarasovskaya N.E., Zhumadilov B.Z.). The doctoral student's contribution to the preparation of the publication is 70%.

Educational and methodical manuals:

1. Interdisciplinary practical training in botany with elements of ecology, evolution and plant genetics / Study guide. – Almaty: Evero, 2021. T. 1, 264 p.; T. 2, 288 p.; T. 3, 228 p. (co-authored with Tarasovskaya N.E., Zhumadilov B.Z.). The doctoral student's contribution to the preparation of the publication is 60%.

2. Field practice: preparation, implementation, storage of material, knowledge control / Study guide. – Almaty: Evero, 2021. Vol. 1, 284 p., Vol. 2, 284 p. (co-authored with Tarasovskaya N.E., Zhumadilov B.Z., Kabdolov Zh.R.). The doctoral student's contribution to the preparation of the publication is 60%.

Achievements, awards:

International competition "Prometheus", held under the auspices of the International Slavic Academy, the work "Interdisciplinary workshop on botany with elements of genetics, ecology and plant evolution" / Gold Medal. – Novosibirsk, Center for Continuing Business Education, International Institute of Innovation and Technology Transfer under the auspices of the West Siberian Branch of the International Slavic Academy.