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THE EXPERIENCE OF USING FIELD RESEARCH IN FORMING PRACTICAL SKILLS OF BIOLOGY STUDENTS

Abstract

This article examines the impact of field research on the formation of practical skills of biology students, based on the global experience of Turkey, the USA, Germany, Kazakhstan and other countries, analyzing the methods and approaches used, as well as evaluating the results of their implementation in the educational process. Because field research is an integral part of the training of biology students, contributing to the development of their practical skills, research thinking and professional competence. In world practice, there are many approaches to organizing and conducting field research based on the specifics of educational systems in different countries, natural features and the level of technological development. The purpose of this article is to compare the experience of using field research in Kazakhstan, Turkey and other countries, as well as to identify common trends and differences in the methodology of their organization. For this purpose, the structures of educational programs, research methods, their impact on the formation of professional skills and the level of preparedness of graduates are considered. The results of the study show that the use of project-based learning during field research contributes to a deeper assimilation of the material, the development of independence and research skills among students. Interdisciplinary projects are widely used in countries with a high level of technological development, in which students solve real environmental and biological problems. At the same time, traditional methods of data collection and processing remain in regions with limited resources, but the project approach is gradually being introduced there. In conclusion, it is noted that combining field work with project-based training is the most effective method of training future biologists, ensuring their competence in modern science and the practical application of knowledge.

Keywords: Educational process; biological education; practical competence; practical skills; biology students.

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БИОЛОГ-СТУДЕНТТЕРДІҢ ПРАКТИКАЛЫҚ DAҒДЫЛАРЫН ҚАЛЫПТАСТЫРУДА ДАЛАЛЫҚ ЗЕРТТЕУЛЕРДІ ҚОЛДАНУ ТӘЖІРИБЕСІ

Аңдатпа

Бұл мақала биолог-студенттердің практикалық дағдыларын қалыптастыруға далалық зерттеулердің әсерін Түркия, АҚШ, Германия және басқа елдердің әлемдік тәжірибесіне сүйене отырып Қазақстан жағдайында қарастырады, қолданылатын әдістер мен тәсілдерді талдайды және оларды білім беру үдерісіне енгізу нәтижелерін бағалайды. Өйткені, далалық зерттеулер – биолог-студенттерді даярлауда тәжірибеге бағытталған білім берудің ажырамас

бөлігі, әрі студенттердің практикалық дағдыларын, зерттеушілік ойлауын және кәсіби құзыреттілігін дамытуға тікелей ықпал етеді. Әлемдік тәжірибеде әр түрлі елдердің білім беру жүйелерінің ерекшеліктеріне, табиғат ерекшеліктеріне және технологиялық даму деңгейіне негізделген далалық зерттеулерді ұйымдастырудың және жүргізудің көптеген тәсілдері бар. Осымен байланысты, зерттеу жұмысының мақсаты – Қазақстанда, Түркияда және басқа елдерде далалық зерттеулерді қолдану тәжірибесін салыстырмалы талдау, оларды ұйымдастыру әдістемесіндегі жалпы тенденциялар мен айырмашылықтарды анықтау. Зерттеу нәтижелеріне қол жеткізу үшін білім беру бағдарламаларының құрылымдары, зерттеу жүргізу әдістері, олардың кәсіби дағдыларды қалыптастыруға және студенттердің дайындық деңгейіне әсері қарастырылды. Зерттеу нәтижелері далалық зерттеулер кезінде жобалық оқытуды қолдану материалды тереңірек игеруге, студенттердің тәуелсіздігі мен зерттеу дағдыларын дамытуға оң әсер ететінін көрсетеді. Технологиялық даму деңгейі жоғары елдерде студенттер нақты экологиялық және биологиялық мәселелерді шешетін пәнаралық жобаларды жасауды кеңінен қолданылатыны анықталды. Ал, ресурстары шектеулі аймақтарда деректерді жинау мен өңдеудің дәстүрлі әдістері сақталған, бірақ жобалық тәсіл біртіндеп енгізілуде. Зерттеудің қорытынды бөлімі далалық жұмыстарды жобалық оқытумен ұштастыру болашақ биолог-мамандарды даярлаудың ең тиімді әдісі ретінде студенттердің заманауи ғылымда және білімді практикалық қолдануда құзыреттілігін қамтамасыз ететіндігін көрсетеді.

Түйін сөздер: Оқу үдерісі; биологиялық білім; практикалық құзыреттілік; практикалық дағды; биолог-студент.

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ОПЫТ ПРИМЕНЕНИЯ ПОЛЕВЫХ ИССЛЕДОВАНИЙ В ФОРМИРОВАНИИ ПРАКТИЧЕСКИХ НАВЫКОВ СТУДЕНТОВ-БИОЛОГОВ

Аннотация

Данная статья рассматривает влияние полевых исследований на формирование практических навыков студентов-биологов, опираясь на мировой опыт Турции, США, Германии, Казахстана и других стран, анализируя используемые методы и подходы, также оценивая результаты их внедрения в образовательный процесс. Так как, полевые исследования являются неотъемлемой частью подготовки студентов-биологов, способствуя развитию их практических навыков, исследовательского мышления и профессиональной компетентности. В мировой практике существует множество подходов к организации и проведению полевых исследований, основанных на специфике образовательных систем различных стран, природных особенностях и уровне технологического развития. Целью данной статьи является сравнительный анализ опыта применения полевых исследований в Казахстане, Турции и других странах, также выявление общих тенденций и различий в методике их организации. Для этого рассмотрены структуры образовательных программ, методы проведения исследований, их влияние на формирование профессиональных навыков и уровень подготовленности выпускников. Результаты исследования показывают, что применение проектного обучения во время полевых исследований способствует более глубокому усвоению материала, развитию самостоятельности и исследовательских умений у студентов. В странах с высоким уровнем технологического развития широко используются междисциплинарные проекты, в которых студенты решают реальные экологические и

биологические задачи. В то же время, в регионах с ограниченными ресурсами сохраняются традиционные методы сбора и обработки данных, но проектный подход постепенно внедряется и там. В заключение отмечается, что сочетание полевых работ с проектным обучением является наиболее эффективным методом подготовки будущих специалистов-биологов, обеспечивая их компетентность в современной науке и практическом применении знаний.

Ключевые слова: Образовательный процесс; биологическое образование; практическая компетентность; практические навыки; студенты-биологи.

Introduction. Field research is a method of data collection in which a researcher observes and interacts with objects of study in their natural environment [1]. This approach allows you to obtain accurate and detailed information that is not available in the laboratory or in desk studies. Field research is a fundamental component of the training of biology students, contributing to the development of their practical skills, professional competence and an in-depth understanding of ecosystem processes. They allow students to apply theoretical knowledge in real conditions, form analytical thinking, interpret the data obtained and develop scientifically sound solutions. Modern research confirms that the inclusion of active teaching methods, such as field expeditions, laboratory workshops and pedagogical workshops, significantly increases the effectiveness of mastering biological disciplines and contributes to the development of students' research culture.

Professor Dyachkova T.V. and associate professor Khitsenko A.V. consider field research as one of the most effective approaches, since it not only promotes the solid assimilation of theoretical material, but also allows it to be applied in practice, developing analytical and research thinking (Dyachkova and Khitsenko, 2020) [2, p.47]. In addition, research in the field of biological education focuses on the importance of an integrated approach that integrates traditional methods with innovative technologies. In particular, professor Kudryashova A.A. and associate professor Sobakina T.G. note that digital technologies, data visualization tools and interactive methods contribute to the formation of critical thinking and information synthesis skills (Kudryashova and Sobakina, 2019) [3, p.69-71].

The applied focus of learning also plays a key role. Professor Akhmedova Z.M. and associate professor Yarovenko E.V. note that laboratory and practical classes contribute to the formation of students' functional literacy and the ability to solve professional problems (Akhmedova and Yarovenko, 2021) [4, p.92-93]. This is especially important in biological sciences, where successful mastery of disciplines requires not only theoretical training, but also active involvement in research activities. Thus, the integration of modern methods into the educational process contributes to better training of future specialists and their successful adaptation in a professional environment.

The importance of field research for understanding the behavior of animals in their natural environment is confirmed by the work of Lepekhin I. (1771), who described the habitats of the Caspian whipsnake in West Kazakhstan and Atyrau regions. These data are relevant for the development of strategies for the conservation of the species and its population management.

Foreign works also serve as confirmation of the importance of field research. For example, Smith and Taylor (2018) point out that students' participation in field research increases their involvement in the learning process and contributes to a better assimilation of biological disciplines. They emphasize: "Practical research in natural conditions develops students not only knowledge about biodiversity, but also skills of critical analysis and scientific thinking" (Smith & Taylor, 2018) [5, 127-132]. In turn, Zhang and Wang (2020) note that modern field research techniques, including the use of drones, GIS-technologies and molecular methods, can improve the accuracy of scientific data and make learning more practice-oriented (Zhang & Wang, 2020) [6, p.33; p.43-45].

Field practices for 2-3-year students are being actively introduced in the educational programs of Kazakhstan and other countries, providing them with the opportunity to study biodiversity in natural conditions. In Kazakhstan, which has a rich biological diversity, conducting field research is

especially important. They allow students to study the local flora and fauna in practice, developing an integrated approach to the study of biology. For example, our students explore the Almaty region and the vicinity of the Kapshagai reservoir, analyzing populations of butterflies, other insects and animals, which helps them develop skills in environmental monitoring and data analysis.

International experience, including the practices of Turkey, the USA, China and Germany, confirms the importance of field research in the training of biologists. In these countries, special attention is paid to the methodological training of students, the use of modern technologies for data collection and processing, and integrated ecosystem research. A comparative analysis of these practices makes it possible to identify effective approaches that can be adapted into educational programs in Kazakhstan, contributing to improving the quality of biological education and training competent specialists. In this regard, the international experience of field research will be reviewed, including key methods and approaches used in various countries.

Materials and methods. The study is based on the analysis of scientific articles, educational programs and statistical data on the results of field practices in different countries. Methods of comparative analysis, working with data and quantitative analysis of the effectiveness of field research were used. The following methods were used for comparative analysis:

- Analysis of scientific publications, dissertations and textbooks on field research in the educational process;
- Comparative study of curricula of biological specialties at universities in Kazakhstan, Turkey and several other countries.

Results. In Kazakhstan, field research is a mandatory component of educational programs in biological disciplines. They are held in various natural areas of the country, including steppes, forest-steppes, deserts and mountainous areas. The main types of field research include:

- Botanical research (study of flora, herbarium collection, ecosystem analysis);
- Zoological research (observation of fauna, analysis of species diversity);
- Environmental research (study of the impact of anthropogenic factors on the environment).

Field research in Kazakhstan contributes to the formation of the following professional skills:

- Identification of plant and animal species in natural conditions;
- Carrying out ecological and geographical analysis of territories;
- Application of tools and techniques for biological data collection;
- Development of scientific projects and writing of reports.

In Turkey, field research also occupies a significant place in the training of biologists. Universities such as Ankara University and Bosphorus University actively include courses in their curricula focused on the study of the flora and fauna of the Mediterranean. Students conduct research in nature reserves, which helps them prepare for future scientific activities. Unlike Kazakhstan, Turkish universities focus on the methodological training of students, orienting them towards future teaching activities. An important feature is the use of modern technologies (drones, satellite imagery, GIS technologies) to collect and analyze data [7]. The main forms of field research in Turkey include:

- Integrated ecosystem research in national parks;
- Study of the biodiversity of coastal zones and marine ecosystems;
- Environmental monitoring and assessment of human impact on the environment.

As a result of field research, students acquire the following skills:

- Application of modern bioindication and monitoring methods;
- Using digital tools for data analysis;
- Development and implementation of educational programs in biology based on field research.

Brazilian universities, such as the University of Sao Paulo, use field research to study the biodiversity of tropical forests. The main focus is on ecosystem monitoring methods and the study of rare plant and animal species [8].

Germany is introducing interdisciplinary approaches to field research, combining ecology, genetics and biotechnology [9, p.357]. Students' complete internships in national parks such as the Black Forest and the Bavarian Forest.

In Russian universities such as Moscow State University and St. Petersburg State University, field research is a traditional part of the educational process [10]. The main focus is on the study of ecology and zoology in various climatic zones.

Now we analyze the similar and different elements in the field research methods of different countries, overlapping elements:

- Application of field research to study biodiversity (Turkey, Brazil, Germany, Russia, Kazakhstan);
- Improving students' practical skills;
- Inclusion of field work in the curriculum.

Differences:

- Germany uses genetic research in field research;
- Brazil focuses on studying rainforest ecosystems;
- Russia focuses on ecology and zoology in various climatic zones;
- Kazakhstan pays attention to the study of steppe and desert ecosystems (Table 1) [11].

Table 1. Comparative analysis of field research experience in different countries

<i>Criterion</i>	<i>Kazakhstan</i>	<i>Turkey</i>	<i>Russia</i>	<i>China</i>	<i>USA</i>	<i>Australia</i>
<i>Main focus</i>	Study of biodiversity and ecology	Methodological training and application of technologies	Expeditions, study of natural zones	Application of GIS and remote sensing	Interdisciplinary approach, technological innovations	Research on organism adaptation to different conditions
<i>Natural zones</i>	Steppes, forest-steppes, mountainous areas	National parks, coastal ecosystems	Forests, steppes, aquatic ecosystems	Various ecosystems from mountains to plains	Forests, rivers, marine coastlines	Tropical forests, deserts, reef ecosystems
<i>Key technologies</i>	Traditional methods, laboratory analysis	GIS technologies, drones, digital maps	Biological monitoring, mapping	Remote sensing, GIS	DNA analysis, bioindication	Satellite monitoring, ecosystem modeling
<i>Practical skills</i>	Species analysis, data collection, mapping	Bioindication, digital data processing	Expedition organization, research methodologies	Big data processing, biodiversity analysis	Study of ecological interactions	Modeling and forecasting ecological changes

Comparative analysis shows that field research contributes to the formation of key professional competencies of students. The Turkish and Brazilian approaches are focused on studying biodiversity, while the German methods involve integration with genetic research. In Russia, field research traditionally focuses on ecology and zoology, while in Kazakhstan it focuses on studying the specifics of steppe and desert ecosystems.

As we can see from Table 1, the common features are: practical training, work in natural conditions, and data collection.

- Kazakhstan: the emphasis is on traditional field methods.
- Turkey: application of modern technologies and techniques.
- Russia: traditional expeditions with a research bias.
- China, USA, Australia: enhanced technology integration into field research [12].

Based on the analysis, several conclusions can be drawn:

- In Kazakhstan, field research is primarily aimed at studying the nature of the region and training specialists for scientific and research activities.
- In Turkey, along with classical methods, digital technologies are actively used, which allows future biologists to master modern approaches to the study of nature.
- Russia retains traditional approaches to field research, with an emphasis on expeditionary work.
- China is actively implementing GIS and remote sensing technologies in research.
- In the USA and Australia, field research is integrated with the latest technologies, including DNA analysis, satellite monitoring, and forecasting ecosystem changes [13, 14].

Here we would like to mention the experience of our Kazakh National Pedagogical University. As part of field practice, students of 2-3 courses of biological specialties conducted research in the vicinity of Kapshagai. The main methods of work are:

- Collecting samples: using nets and traps to catch butterflies and other insects.
 - Species identification: identification of collected specimens using determinants and reference books.
 - Behavior observation: recording the behavioral characteristics of animals in their natural habitat.
 - Documenting data: keeping field diaries, photographing and videotaping for further analysis.
- The practice is conducted under the guidance of teachers and researchers who provide methodological support and quality control of the work performed.
- Field research in the vicinity of Kapshagai allowed students to:
- Identify more than 50 species of butterflies, including rare and endemic species.
 - To identify the features of seasonal population dynamics of various species.
 - Observe and describe the behavioral strategies of butterflies in a changing environment.
 - Collect data on the interaction of butterflies with other components of the ecosystem, including plants and predators.

The results obtained contribute to an in-depth understanding of the ecology of native species and their role in the ecosystem.

Now let's give an example of a lesson plan where field research is used (Table 2).

Table 2. Lesson Plan

<i>Lesson Stage</i>	<i>Time</i>	<i>Teacher's Activity</i>	<i>Students' Activity</i>	<i>Notes</i>
Introduction	15 min	Discusses the ecosystem and behavior of local animals, provides textbook examples.	Participate in discussion, share knowledge.	Examples of habitat influence on behavior.
Field Trip	90 min	Coordinates the visit to a natural area, gives observation instructions.	Observe animals, fill out a questionnaire (record behavior, habitat).	Park, nature reserve, or another natural area.
Data Collection	60 min	Assists students in using mobile applications and documentation methods.	Take photos of animals, record characteristics,	Use of iNaturalist or similar apps.

			compare with textbook data.	
Data Analysis	30 min	Guides discussion, helps interpret data.	Present observations, discuss conclusions.	Group work, presentations.
Conclusion	15 min	Summarizes findings, asks reflection questions.	Discuss the importance of field studies, share impressions.	Evaluation of the study's significance.

An analysis of international experience shows that, despite the general principles of organizing field research, each country develops its own unique methods focused on the natural features of the region and educational priorities. Kazakhstan focuses on studying steppe and desert ecosystems, Turkey actively uses digital technologies to monitor the environment, Germany integrates genetic methods into environmental research, and the United States and Australia use innovative technologies to predict ecosystem changes.

The experience of the Kazakh National Pedagogical University confirms the importance of field research in the educational process. Practicing in the vicinity of Kapshagai allows students not only to study the biodiversity of the region, but also to master modern methods of data collection and analysis. Such studies help develop critical thinking, field observation, information processing, and teamwork skills. The introduction of lesson plans using field research contributes to improving the quality of education, motivates students to independent research activities and strengthens their connection with real scientific practice. This approach allows us to train highly qualified specialists who are able to solve current problems in the field of ecology, zoology and botany.

Thus, further development of field research in educational programs requires the integration of modern technologies, interdisciplinary approaches and the exchange of international experience. It is important to continue adapting fieldwork techniques to reflect new scientific achievements and the needs of the professional field in order to provide students with relevant knowledge and practical skills for a successful career in biology.

Discussion. In comparison with previous studies [15, 16], this work focuses on an integrated approach to the study of animals in their natural habitat. Unlike laboratory research, field practice allows students to interact directly with the objects of study, which contributes to a deeper understanding of environmental processes. In addition, research in the local area provides unique data on the fauna of the region, previously insufficiently studied. Based on the analysis, several conclusions can be drawn, and this distinguishes this work from other studies conducted in more studied regions.

- In Kazakhstan, field research is primarily aimed at studying the nature of the region and training specialists for scientific and research activities.
- In Turkey, along with classical methods, digital technologies are actively used, which allows future biologists to master modern approaches to the study of nature.
- In Germany, field research is integrated with genetic analysis and bioinformatics, which expands the possibilities of studying biodiversity at the molecular level.
- China uses remote sensing and GIS technologies to monitor ecosystem changes in conditions of active urbanization and climate change.
- In the USA, research is focused on the application of the latest technological solutions, including DNA analysis and satellite monitoring, which makes it possible to create predictive models of ecosystem processes.
- In Australia, considerable attention is being paid to studying the adaptation of organisms to extreme conditions such as drought and climate change.

In other countries, field research plays an important role in developing students' professional skills, but in Turkey it is additionally focused on the methodological training of teachers. At the

same time, Turkey's experience seems to be the most relevant for Kazakhstan, as it combines traditional field research methods with the active introduction of digital technologies. Such an approach can contribute not only to expanding the possibilities of monitoring biodiversity, but also to improving the methodological training of future teachers. Further research in this area should be aimed at exploring ways to integrate digital technologies into field research in Kazakhstan, as well as analyzing the effectiveness of their use in the educational process.

Conclusion. Field research is an important tool in the training of biology students, contributing to the development of their practical skills and professional competence. The experience gained during field practice allows students not only to deepen their knowledge of the local fauna, but also to master the methodology of scientific research in real conditions. This highlights the importance of integrating field research into educational programs to train highly qualified specialists in biology. International experience shows that the integration of practical research into the educational process significantly increases the level of competence of students. Approaches to their organization may vary depending on the country and the educational system, but general principles include the formation of practical skills, the study of biodiversity and the development of research thinking. Especially a comparative analysis of the experience of Kazakhstan and Turkey shows that the integration of traditional and modern methods is the most effective way to train future specialists in the field of biology. In this regard, in the future, it is planned to conduct interviews and questionnaires of Turkish teachers and students participating in field research to develop recommendations for adapting world practices in Kazakhstan and improving the quality of biological education.

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