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"Case studies" and research design in the formation of competencies for bachelors in the field of "Biotechnology"

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Abstract. In modern Russian education there is a process of transition to the subject-subject interaction of a teacher and a student in the learning process. Truly innovative pedagogical technologies are initially built on a competency-based approach and are aimed in learning outcomes at the future professional activity of a graduate. The case method is one of the most significant ones for modern higher education. A consistent combination of pedagogical technology of situational analysis and research design based on the principles of contextual training of students in the direction of training "Biotechnology" at the Federal Budgetary Educational Institution of Higher Education "Altai State University" within the framework of academic disciplines allows successful development of professional and universal competencies, as well as realization of personal qualities. The result of the work of the teacher and students is an intellectual product of a biotechnological research project.

1. Introduction

Currently, in the market economy the traditional training of students of natural science specialties, which takes into account only the requirements of the Federal State Educational Standard of Higher Professional Education (FSES HPE), does not meet the modern needs of the labor market. If earlier, during the period of the distribution system, a graduate of a university could gradually adapt to the working conditions during the period of labor activity at an enterprise for distribution, today it is required that such specialist should fully professionalize the appropriate level of competence immediately after graduation. In modern Russian education there is a transition to the subject-subject interaction of learners, teachers and students in the learning process. It is also important that truly innovative pedagogical technologies are initially built on a competency-based approach and are aimed at learning outcomes for future professional activities. The case method is one of the most significant for modern higher education.

A case is an analysis of a situation or a specific case, a business game. It can be called the technology of analysis of specific situations, "special case". The essence of the technology lies in the fact that it is based on descriptions of specific situations or cases. The case presented for analysis should reflect a real-life situation, the description should contain a problem or a number of direct or indirect difficulties, contradictions, hidden tasks for the researcher to solve. Mastering a preliminary set of theoretical knowledge is required in order to refract it into the practical plane of solving a specific problem or a number of problems. In the process of working on a case, students need additional information when analyzing the situation. Ultimately, students find their own conclusions, solutions from a problem situation, and often, in the form of ambiguous multiple solutions [1].



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"Case studies" is an interactive technology, as it initially introduces students into the process of subject-subject relations "horizontally", gives students the opportunity to show activity, initiative, independence in agreement with the opinions of their comrades, as well as the right of everyone to their own opinion. But, the most important thing is that this approach is directed beyond the educational space, goes into the sphere of professional solutions to problems in this area of knowledge, forms interest and profile motivation. Here, as in true innovative technologies, educational knowledge and the educational process as a whole are not an end in themselves, but a tool for the student's inclusion in competence-based learning.

Competence is the ability of a student to apply the entire set of acquired knowledge, abilities, skills, experience and personal qualities to solve professional problems. The competence-based approach is aimed at developing the ability to act correctly in problem situations, acquiring professional skills [2].

In the course of solving the case, students develop abilities for analysis and synthesis, improvisation, intuition, variability, which are the most important elements of thinking. Joint activity with the teacher forms a community of meanings, goals and contributes to the achievement of learning outcomes [3]. At the same time, the teacher acts as a moderator, an accomplice in the search process, performing flexible management functions. Project-based learning is built on the principles of humanization, communication, activity, value approaches, focused not only on the formation of competencies, but also on the self-realization of the individual. The peculiarities of project-based teaching are its dialogic nature, problematization, integrativeness, context [4].

The purpose of the study was to use a contextual approach with case study technologies and research design to form the professional competencies of biotechnology bachelors.

2. Materials and research methods

The development of universal, general professional and professional competencies of bachelors-biotechnologists is implemented within the context of a number of courses, such as the following: "Theoretical Foundations of Modern Biotechnology", "Medical Biotechnology", "Agricultural Biotechnology", "Plant Biotechnology" and others. In our work, we used the technologies of situational analysis ("case study") and group research design. The concept of creating a small innovative enterprise in the field of biotechnology served as a link between different areas of modern biotechnology, bioeconomics and management.

The type of "case" which was used was a practical one. These cases should reflect the introduced situation or case as realistically as possible. The purpose of this case is to practice the skills of refraction of educational, subject knowledge and skills into the post-educational, professional-activity space of real life.

A group of 2-year undergraduate students in Biotechnology included 15 people. The results were assessed by the quality of the development and analysis of case problems, as well as by the defense of research projects with the effect of further implementation by students.

3. Results and discussion

The concept of the educational program for the training of students enrolled in the direction of training "Biotechnology" provides, in general, the preparation of graduates for production, technological, organizational and managerial, research and design activities. The professional activity of graduates is most often associated with the chemical, food, pharmaceutical industry and related sectors of the economy [5].

The educational process at Altai State University is based on the material and technical base, research, production and intellectual potential of such scientific departments as the following ones: South Siberian Botanical Garden, Research Institute of Biomedicine, Department of Biotechnology. When implementing a bachelor's program in Biotechnology, Altai State University focuses on the introduction of biotechnology in agriculture, processing and pharmaceutical industries, taking into account the needs of the labor market, research and material and technical resources of the Altai Territory.

In the field of biotechnology, case tasks are formulated in connection with the region's need for raw materials for the pharmaceutical industry, in creating new varieties and obtaining planting material for agricultural crops, utilizing agricultural waste, developing biological means of protection against pests and diseases of agricultural plants and animals, and others. Students develop in pairs the concept of creating their own small innovative enterprise in the chosen field of activity, and give calculations of the planned financial activity. The obtained data are presented in the form of reports with presentations at seminars. In the discussions, students very zealously defend their "brainchild" - the project of an innovative enterprise. As a result of the application of the "case study", a high level of personal motivation was revealed, and the ability to creatively use the accumulated baggage of fundamental and applied knowledge in the field of biotechnology, economics, and management.

Modern production conditions, associated, for example, with the production of medicinal plant materials under controlled conditions and the transition to its low-waste processing, predetermine the need for continuous improvement of innovative technologies and biotechnologies. In this regard, project training was used, which complements the "case studies" and allows you to generalize and structure the information collected during the development of the project of an innovative enterprise and transform it into the final intellectual product of the protected project. Students carried out research in the field of plant biotechnology, developed their research project on the basis of their own, fund and published materials in this field.

The research project had the structure and nature of research work with additional emphasis on the problem statement, working hypothesis, and the socio-economic significance of the results [6].

The following topics for biotechnology projects were proposed:

- Study and development of technological modes of tissue culture of *Iris sibirica* L. for targeted biosynthesis of flavonoids.
- Development of biotechnology for obtaining plant raw materials *Iris Spuria* L. with a given content of extractives.
- Biotechnology of obtaining raw materials for *Scutellaria baicalensis* Georgi. And its chemical analysis.
- Features of in vitro cultivation of St. John's wort (*Hypericum perforatum* L.) and phytochemical composition of its extracts.
- Obtaining biomass, its components by biotechnology and analysis of metabolic products of anise lofant (*Agastache foeniculum* L.).
- Development and validation of a method for the quantitative determination of xanthones in iris raw materials
- Development of resource-saving biotechnology for obtaining medicinal plant raw materials.
- Development of methods for assessing the quality of medicinal plant materials obtained under controlled conditions.
- Methods for obtaining essential oil from biotechnological plant raw materials and its phytochemical control.
- Complex chemical processing of medicinal plant materials obtained by biotechnology methods.

The development of a research project was carried out in several stages: collecting and structuring information, posing a problem and choosing adequate methods for solving it, acquaintance with the experience of solving similar problems, obtaining laboratory research results, analyzing the results obtained and writing a report, video presentation of the results, discussion in the scientific community, formulation of conclusions and practical recommendations.

Students discussed their work with the teacher at all stages, consulted with biotechnologists, looked for answers to problematic questions in scientific literature [7-9]. As a result, we received an up-to-date scientifically grounded project. This work helped to qualitatively prepare and defend the final qualifying work. The best works are presented at the annual Winter Youth Scientific School "Promising Areas of

Physical and Chemical Biology and Biotechnology" (Moscow), the All-Russian Scientific and Practical Conference of Students, Postgraduates and Young Scientists with International Participation "Technologies and Equipment for the Chemical, Biotechnological and Food Industry" (Biysk), Scientific-practical conference "From bioproducts to bioeconomics" (Barnaul).

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4. Conclusion

Thus, a consistent combination of the pedagogical technology of situational analysis and research design based on the principles of contextual teaching of biotechnology students within academic disciplines allows us to successfully develop professional and universal competencies, as well as to realize personal qualities. The result of the work of the teacher and students is an intellectual product of a biotechnological research project.

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