



THEORETICAL FOUNDATIONS OF TEACHING NATURAL SCIENCES TO LEARNERS

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Abstract. This article examines the theoretical foundations, content, and pedagogical-didactic features of teaching natural sciences to learners. Particular attention is paid to integrating learners' existing knowledge and experience with new scientific concepts, establishing interdisciplinary connections, and linking theoretical knowledge with practical activities. The educational potential of organizing the content of biology, chemistry, physics, and geography based on an integrative approach is analyzed.

Keywords: natural sciences, learners, theoretical foundations, natural science education, didactic approach, integrative approach, interdisciplinary connections, scientific worldview, practical skills, independent thinking, natural phenomena, methodological training.

Today, modern scientific and technological development, the rapid advancement of digital technologies, and the growing demand of society for highly qualified specialists necessitate the improvement of the content and methodology of teaching natural sciences within the education system. In particular, teaching natural sciences such as biology, chemistry, physics, and geography in an interconnected manner enables learners to approach nature and the processes occurring within it from an integrated scientific perspective. In this regard, one of the important pedagogical tasks is to organize the teaching of natural sciences not merely as the transmission of knowledge within individual disciplines, but by integrating interdisciplinary connections, an integrative approach, and practical activities.

In the modern educational process, the learner is no longer regarded as a passive subject who simply acquires ready-made knowledge, but rather as an active learner capable of independently searching for, analyzing, comparing, generalizing, and applying knowledge in practical situations. This requires ensuring a close connection between theoretical knowledge and practical activities in the teaching of



natural sciences. Understanding the essence of natural phenomena and processes, identifying cause-and-effect relationships, drawing conclusions based on scientific evidence, and solving real-life problems are important factors in developing learners' scientific worldview and scientific literacy.

The theoretical foundations of teaching natural sciences are primarily based on the principles of scientific validity, consistency, systematicity, comprehensibility, and practical orientation of educational content. In this context, taking learners' prior knowledge and experience into account, connecting new scientific concepts with existing knowledge, and reinforcing theoretical material through experiments, observations, laboratory activities, and practical assignments represent effective pedagogical approaches. In particular, identifying common patterns within the content of natural sciences and integrating knowledge from different disciplines contribute to the development of learners' ability to approach phenomena systematically.

LITERATURE REVIEW AND METHODOLOGY

In the Republic of Uzbekistan, issues related to teachers' professional development, innovative education, and the improvement of professional qualifications through information and communication technologies have been investigated by B. S. Abdullayeva, E. M. Alkarov, A. R. Aripdjanova, A. D. Asqarov, U. Sh. Begimqulov, R. Kh. Djurayev, A. S. Djurayev, Kh. I. Ibragimov, R. G. Isyanov, U. Masharipova, S. Yu. Makhmudov, M. T. Mirsoliyeva, N. A. Muslimov, Sh. O'. Nurullayeva, A. B. Radjiyev, N. I. Taylaqov, and O'. Q. Tolipov.

The theoretical and methodological foundations for the development of natural science teaching have been studied by U. Rakhmatov, J. O. Tolipova, G. S. Ergasheva, L. Qorakhonova, A. A. Khaitov, M. Nuriddinova, Z. B. Sangirova, and M. K. Shirinov.

The new stage of the educational reforms being consistently implemented in our country requires a reconsideration of general strategic approaches to teachers' professional development in terms of their content and the identification of priority tasks on this basis. Particularly in the current context of increasingly deepening social, economic, and educational relations among countries worldwide, studying the professional development system of preschool and school education personnel in the Republic of Uzbekistan separately from the development trends observed in the global educational space does not provide a sufficiently strong scientific basis.



One of the important means of increasing the effectiveness of teaching natural sciences based on an integrative approach is to thoroughly study the theoretical perspectives, methodological approaches, and practical experiences developed in foreign education systems concerning teachers' professional training, competence, and continuous professional development. At the same time, analyzing the content of international legal and regulatory documents, generalizing the results of scientific research conducted in this field, and adapting them to the national educational context constitute important scientific and practical tasks.

Within the framework of the study, it was considered appropriate to examine the experience of foreign education systems in the following areas: first, analyzing the current state of continuous professional development systems for natural science teachers in foreign practice and identifying their specific characteristics; second, determining the leading and priority directions for developing continuous professional development systems for teachers; and third, identifying the socio-pedagogical conditions that would enable the effective use of foreign experience in organizing the teaching of natural sciences based on an integrative approach and the process of teachers' self-directed professional development under the conditions of Uzbekistan.

In recent years, measures implemented worldwide to organize and develop adult education have significantly strengthened the theoretical and practical foundations of this field. In particular, during the Sixth International Conference on Adult Education (CONFINTEA VI), held in Brazil in 2009, the need to recognize non-formal education for adults as an integral component of lifelong learning was particularly emphasized by the international community [2, p. 89].

For natural science teachers, a number of important tasks have been identified, including the introduction of induction programs during the first three years of professional activity; establishment of a system of consultation and methodological support provided by experienced colleagues; development and discussion of professional development programs based on the development needs of the schools in which teachers work; creation of the necessary conditions for continuous professional development aimed at systematically improving acquired competencies; and expansion of opportunities for continuous professional development in the field of natural sciences.



In the German experience, the professional training of modern natural science teachers is organized on the basis of innovative pedagogical technologies. In this context, project-based learning, work in small groups, problem-based learning, pedagogical skills workshops, teaching in didactic centers, and “open lessons” are regarded as effective means of developing teachers’ professional potential [2, p. 89].

In the Chinese education system, particular attention is being paid to STEAM technology as one of the contemporary forms of the integrative approach. According to investment research conducted by the international company EqualOcean and information provided by web resources operating in the field of information services in China, STEAM technology is considered one of the most popular educational directions among the educational approaches being promoted in the Chinese education system [2, p. 89].

Taking into account the experience of foreign countries, identifying the conceptual foundations for establishing a modern system of continuous professional development is one of the pressing tasks. In this regard, it is important to develop practically applicable mechanisms for the effective functioning of such a system, regularly analyze its effectiveness through systematic monitoring, develop corrective measures in accordance with the identified needs, and continuously improve professional retraining processes. In this sense, such a system can provide a sustainable response to structural imbalances arising under conditions of global financial and economic crises.

At the same time, in the formulation of state policy on personnel training and in planning the activities of professional development institutions, the preparation of specialists with innovative potential, stimulation of their professional growth, and support for their initiative should be incorporated as distinct functional areas. This approach contributes to qualitative growth in human capital through the renewal of educational content, revision of curricula, improvement of textbooks and teaching and methodological resources, and modernization of teaching technologies.

The advanced experience accumulated in developed countries in the areas of professional development, continuous improvement, and management of natural science teachers’ qualifications not only provides opportunities for adopting new approaches but also contributes to the development of teachers’ social, cultural, and professional potential. Ultimately, this serves as a strong foundation for ensuring the



sustainable improvement of the quality of preschool and general secondary education.

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