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MODELS OF PROFESSIONAL DEVELOPMENT FOR BIOLOGY TEACHERS IN THE CONTEXT OF SOCIAL CHANGES

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Abstract. *This article aims to explore the impact of social changes on the professional development of biology teachers. The purpose of the study is the analysis of modern challenges in the field of education and the development of a model of professional growth of a biology teacher. The following methods are employed in the study: analysis and synthesis of literature on the research topic to determine the current state of the investigated problem, systematic analysis, and synthesis of obtained information to identify the main models of professional development for biology teachers.*

The regulatory framework ensuring conditions for the professional development of teachers has been analyzed. Modern economic and technological changes, socio-cultural and political transformations, dynamics of interethnic and cultural relations in Ukraine, high population mobility, and migration processes affect the education system and the professional development of teachers.

In the scientific discourse, among effective models of professional development for teachers, scholars distinguish: concepts of teaching and development of teachers' professional abilities based on knowledge (knowledge for practice, knowledge in practice, personal knowledge); models of professional development for educators (training model, award-bearing model, deficit model, cascading model, standards-based model, coaching/mentoring model, community of practice model, action research model, transformational model); competency, cognitive, human-centered models; models of applied science, craftsmanship, reflective, apprentice-expert model, rationalist model, case studies model, cascading.

The author proposes an original model of professional development, which involves six stages: analysis of contemporary challenges, professional training based on teachers' needs, creation of an individual development plan, integration of innovative technologies into professional activities, self-evaluation, and the establishment and support of professional communities.

The main research results indicate the need to reconsider traditional approaches to teaching biology and emphasize the use of modern technologies in the professional development of teachers for successful implementation of changes in the educational environment.

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Introduction

Ukraine, like other countries, is undergoing profound and rapid social changes that undoubtedly affect the education system and the development of teachers. These changes influence various aspects of the pedagogical sphere and pose new challenges and tasks for teachers. Modern labor market requirements force schools to adapt to the needs of the digital society. Modern teachers must possess cutting-edge technologies and methodologies to effectively prepare students for the rapidly changing world. Sociocultural and political transformations place the task of educating citizens who understand and respect diversity, can think critically, and actively engage in society. Teachers become not only knowledge mediators but also shapers of civic consciousness. The dynamics of interethnic and cultural relations in Ukraine necessitate the development of inclusive approaches in education. Teachers must be prepared to work with students from different cultures, promoting understanding and tolerance. High population mobility and migration processes create challenges for the education system as teachers encounter diversity in languages and cultures in classrooms. This requires teachers to develop intercultural competence and adapt to the needs of migrant children. All these factors highlight the necessity for continuous self-improvement and professional development for teachers. Education transforms into a constant process of adaptation and innovation, and teachers become agents of change, actively contributing to the formation of creativity, critical thinking, and readiness for social participation among the younger generation. Modern social and cultural transformations not only define a new context for education but also make the teaching profession even more responsible and crucial for shaping civil society. Teachers must be prepared for challenges, providing students with not only knowledge but also the skills necessary for successful living in the modern world.

Globalization processes have significantly impacted the societal life in the country. The need for reforms in the education sector has been relevant since gaining independence. The educational system in Ukraine has undergone a substantial transformative path, with the key aspect being the renewal of the system of professional development for teachers in secondary schools (Kurish, 2022).

Literature Review

Issues of professional development models for teachers are considered in numerous scientific studies by both foreign and domestic scholars (Kennedy, 2005; Cochran-Smith, 2001; Vorotnikova, 2018; Dubasenyuk, 2018; Kovalchuk, 2015, 2018, 2017, 2020, 2021; Kurish, 2022; Pukhovska, 2011).

Methodology

The research is based on the following methods: analysis and synthesis of literature on the research topic to determine the current state of the investigated problem; systematic analysis and synthesis of obtained information to identify the main models of professional development for biology teachers.

Research Results

In Ukraine, a regulatory framework has been established to ensure the professional development of educators, namely: the Law of Ukraine "On Education" (articles 53, 54, 59) affirms the teacher's right to lifelong learning and academic mobility, the choice of types and forms of professional growth, and educational activity subjects (Law of Ukraine "On Education," 2017); the Law of Ukraine "On Complete General Secondary Education" (article 51) specifies that every pedagogical worker must annually enhance their qualifications (Law of Ukraine "On Complete General Secondary Education," 2020); the Procedure for the professional development of pedagogical and scientific-pedagogical workers, approved by the Cabinet of Ministers of Ukraine on August 21, 2019, No. 800, with amendments No. 1133 of December 24, 2019, regulates the right of a pedagogical worker to independently choose specific types, forms, directions, and subjects of qualification enhancement (Procedure for the professional development of pedagogical and scientific-pedagogical workers, 2019).

In the context of modern societal changes in the professional development of teachers, various innovations are introduced, such as the development of digital education. Teachers now have the opportunity to choose forms, methods, and conditions for their professional development, and models of professional development for teachers are evolving and being updated. To illustrate different approaches to building models of professional development for teachers, let's summarize the models defined by domestic and foreign researchers.

In global practice, various approaches to constructing models of professional development for future and current teachers are distinguished. M. Cochran-Smith identifies three different concepts of teaching and development of teachers' professional abilities based on knowledge: a) knowledge for practice - formal knowledge obtained by researchers outside the school (e.g., new theories of

teaching, learning, and assessment, research-based programs, etc.); b) knowledge in practice - practical knowledge accumulated by teachers through their own systematic research, improving the effectiveness of their pedagogical activities; c) personal knowledge - knowledge obtained through reflection on their own activities (Cochran-Smith, 2001).

Researcher A. Kennedy identifies several models of professional development for educators, namely:

1. Training Model
2. Award-bearing Model
3. Deficit Model
4. Cascading Model
5. Standards-based Model
6. Coaching/Mentoring Model
7. Community of Practice Model
8. Action Research Model
9. Transformative Model.

Kennedy argues that the most promising model is the Transformative Model, which describes the dominant characteristics of a transformative approach to the professional development of teachers (Kennedy, 2005). Pedagogical modeling contributes to the formation of a modern professional capable of competing in the job market by possessing necessary professional competencies. The model of a teacher's professional activity is a significant source of the content of their professional training, enhancing the efficiency of organizing and implementing the educational process. The primary goal of modeling the professional competence of a biology teacher is to develop a model aimed at improving the efficiency of the process of developing the professional competence of teachers in the system of postgraduate education and aligning it with the requirements of modern society.

Let's analyze the features of modern models of professional training for andragogy educators. The model of professional-pedagogical training for a teacher can be presented in the unity of several aspects of its application, namely epistemological, as an element of the process of cognition of this pedagogical phenomenon; general methodological, as there is a need to evaluate the connections and relationships between the components of professional-pedagogical education (cognitive, competency-based, axiological, reflective, etc.) as well as between the characteristics of their formation in the process of developing the investigated phenomenon (Berns, 2011).

O. Dubasenyuk examines the modeling of the professional development process of teachers through the lens of andragogy – adult education. Based on the principles of andragogy, we can identify the following models: competency-based, cognitive, and person-centered. Let's consider these models in more detail. The competency-based model assumes that the teacher's competency

characteristics are dominant in the structure of teacher training. The basis of the competency model is professional competence. The competency approach is aimed at developing the teacher's ability to effectively use knowledge, skills, abilities, values, and psychological characteristics of personality, as well as informational, human, and material resources to achieve goals. This approach primarily involves focusing on the learning outcomes in the practical dimension. The cognitive model is based on a diverse spectrum of knowledge used by the teacher for their own professional and personal development. The model is aimed at implementing the cognitive component in the system of professional development. The person-centered model is based on the principles of a person-oriented approach and develops qualities that are important for the professional and personal development of teachers. Coaches, methodologists, and mentors, in collaboration with teachers, should be familiar with the physiological, socio-cultural, and psychological aspects of adult characteristics. It is necessary to consider the needs of adults, including the hierarchical order of needs, as well as internal motivation, driven by the need for self-realization (Dubasenyuk, 2018).

Analyzing the peculiarities of modern models of teachers' professional training in the context of societal changes, we can add the following models to the mentioned list: Applied Science, Craft, Reflective, Apprentice-Expert, Rationalist, Case Studies, and Cascade Models (Vorotnikova, 2018).

In the Applied Science and Rationalist models, teachers learn based on scientific theories taught by experts in a specific field. Only after mastering these theories do teachers begin to practice. The advantage of these models is their consideration of acquiring new scientific knowledge. However, a disadvantage is their inability to apply "scientific" solutions to various professional dilemmas that teachers face in real classroom situations.

The artisan model is the oldest form of professional education and is still used in pedagogical education. It can be applied in conjunction with the training model. The models are based on collaboration between novice teachers and expert teachers. The artisan model is conservative, relying solely on imitation and not incorporating relevant scientific knowledge. This model does not provide opportunities for the development of teachers' creativity. The model is skill-based, focusing on general or specific methods such as interactive teaching, classroom management, student questioning, and lesson planning. Practicing teachers learn by imitating all teaching methods used by experienced teachers. Knowledge is acquired through observation, learning, and practice. Teachers can quickly imitate expert teachers (Vorotnikova, 2018). The suggested model can be used in the following ways: training - using existing algorithms, utilizing ICT (information and communication technologies); development and implementation of own teaching methodology in new conditions. Teachers repeat the algorithms proposed by expert teachers but may not understand all the advantages, disadvantages, and consequences of implementing specific methods in

specialized activities. Recent events expand teachers' opportunities by allowing them to use cloud computing technologies. This enhances the efficiency of the educational process for both students and the development of teachers' abilities. These technologies provide opportunities for resource sharing and collaboration. Thanks to cloud technologies, it is possible to improve knowledge remotely in real-time, working on shared documents, projects, and tasks (Kovalchuk, 2018; Kovalchuk, 2021).

A widely used and relevant model today is the reflective model. The reflective model is based on the assumption that teachers develop their professional competence by reflecting on their own practice. Using their experience of professional activity, teachers can plan and implement their professional development. The model consists of three stages: preparation, professional development, and professional competence. Researchers understand the reflective model as a cyclical and continuous process of development. Thus, teachers make decisions and contemplate possible actions that can be applied in their own practice. Reflection helps teachers avoid various professional dilemmas in the future by remembering, evaluating, and creatively approaching past experiences. The drawbacks of this model lie in the fact that experience is personal, not shared, not fully discussed, and not structured.

The "cascade" model is often used in postgraduate education. Knowledge is usually transmitted from experts through seminars and masterclasses. Mentoring models or coaching models are becoming increasingly popular with the development of information and communication technologies. Teachers plan their own professional development and choose the educational institution, trainer, or expert. Methodologists often act as mentors. One of the labor functions of a methodologist is the methodological support of the professional development of educational workers. Methodologists have the following tasks: organizing the process of continuous professional development of educational workers; assisting teachers in choosing forms and methods of teaching and educating learners; assisting in the development of teaching methods for lessons and extracurricular activities and improving the educational process; consulting educational workers in developing authorship educational programs, creating and publishing printed and electronic products.

When discussing models of professional development within the Ukrainian education system, it is pertinent to consider the integration of European experience in the professional development of educators. Key nuances of the European educational system include decentralization of postgraduate pedagogical education, professional development of teachers based on school needs and individual interests, active collaboration between schools and universities or qualification improvement institutions, support for teachers by university professionals, government bodies, and community representatives, diverse forms of qualification enhancement, organizational support for teachers

in professional development, the development of a system to incentivize educators based on qualification improvement results, the use of distance learning as an alternative form of training and retraining, and the involvement of non-governmental organizations in the professional development of educators. These steps should be taken into account when developing an effective model for the professional development of teachers in Ukraine based on their personal needs and professional growth requirements (Kovalchuk, 2015).

The analysis of scientific works allows us to propose the following model of professional development for biology teachers in the context of societal changes (Figure 1):

The proposed model aims to create a flexible and innovative environment for the professional development of biology teachers, considering the importance of adapting to modern challenges in society.

The conditions of the pandemic and war have necessitated the adaptation of most models, as society grapples with issues in education amid rapid technological and social changes, particularly in the realm of online and distance learning. In this context, the development of teachers' digital competence, digital literacy, and changes in teaching behavior through the use of online tools and services is of particular importance. When addressing the issue of modeling the professional development of biology teachers in the present, it is essential to focus on the availability of open online resources for qualification improvement, enabling teachers to ensure continuous professional development. To implement all the competencies of teachers in practice, the development of skills such as time management, communication, and technology is crucial. These skills respond to society's need for qualified personnel, the rapid development of ICT, the digitization of education, the increase in electronic resources, and certain somewhat outdated conservative views of teachers on innovative forms and methods of working with students (Kovalchuk, 2017; Kovalchuk, 2018).

It is noteworthy that some scholars point out the lack of systematicity, clear provisions, and general consensus in research related to optimal characteristics and practices for successful support of changes in teachers and students. General principles and guidelines for personal professional development are often applied to online courses and programs, but without a thorough consideration of how specific research translates into an online environment (Pukhovska, 2022).

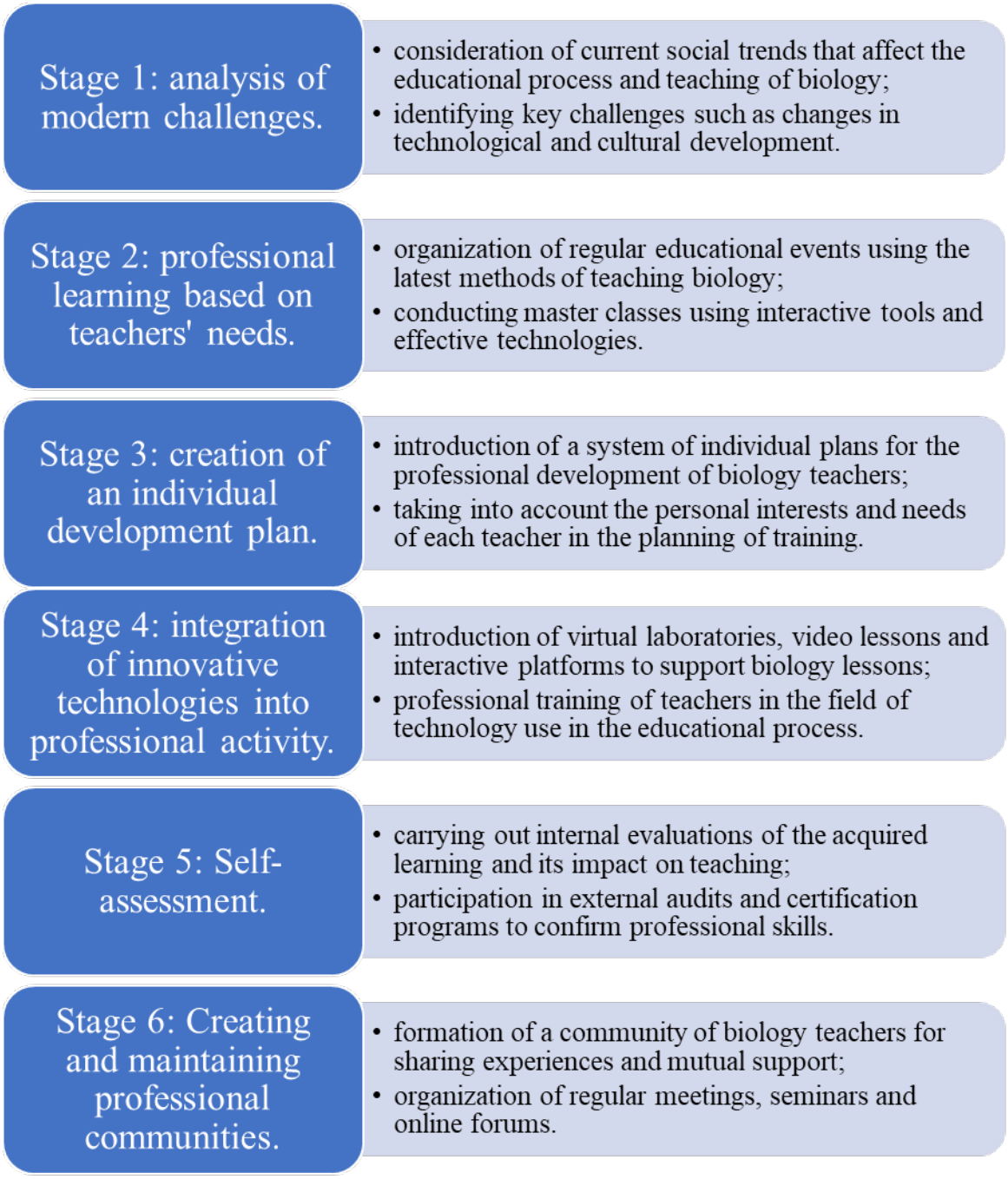

Figure 1 ***Model of Professional Development for Biology Teachers***
(Source: compiled by the authors)

In today's social conditions, there is a need to create an environment for the professional development of teachers in every educational institution. Establishing such an environment for the professional development of biology teachers in a general educational institution is crucial given the rapid changes in science and education, requiring teachers to constantly update their knowledge and teaching approaches. Professional development allows teachers to

incorporate the latest scientific discoveries into their teaching. The high demands for the quality of education task teachers with ensuring effective teaching and upbringing methods. Facilitating the professional development of biology teachers helps improve the quality of the learning process, providing students with more qualitative knowledge in each specific educational institution. Additionally, creating conditions for professional development enhances the motivation of teachers. Participation in a community of teachers, collaborative research, and the exchange of experiences can significantly increase job satisfaction and contribute to a creative approach to teaching. Furthermore, adapting to new challenges in modern society requires flexibility and the ability to implement modern approaches in teaching. Professional development helps teachers effectively meet these demands. The environment of professional development fosters the formation of leadership qualities and teamwork among biology teachers, which can positively impact collective efficiency and the exchange of experiences.

Conclusions

In the context of contemporary societal changes, such as the pandemic and the wartime situation, models of professional development for biology teachers require attention and adaptation. It is clear that the challenges associated with rapid technological and social changes demand from educational professionals deep digital literacy and the ability to effectively integrate online technologies into the learning process. The priority is the development of digital competence among teachers, as it becomes crucial for successful teaching in the conditions of distance education. However, it is important to consider that scientific research in this field requires more systematicity and consensus. The absence of clear provisions and specific principles regarding the professional growth of biology teachers in research can complicate the development of optimal practices to support teachers in implementing changes in the modern educational environment. The ability to choose models, forms, and means of professional development facilitates the process of updating knowledge and improving the skills of teachers based on their needs. In general, the development of models of professional development for biology teachers in the context of societal changes requires coordinated action among researchers, educators, and governing structures to create an effective educational paradigm that takes into account the challenges of the present. Based on the analysis of scientific works, a model of professional development of a biology teacher is proposed, which includes: analysis of modern challenges, professional learning based on teachers' needs, creation of an individual development plan, integration of innovative technologies into professional activity, self-assessment, creating and maintaining professional communities.

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