

ABSTRACT

of the thesis «Formation of research skills of future physics teachers in the context of a practice-oriented approach to teaching», submitted for Doctor of Philosophy (PhD) degree by Bitibayeva Zhazira on 6D011000 – Physics specialty

Research relevance. The positive changes that have taken place over the last decades in the Republic of Kazakhstan have been reflected on the training system of teachers. Educational programs of pedagogical specialties are actively changing. Pedagogical higher education institutions strive to provide schools with highly qualified specialists who are ready to solve educational, general pedagogical and methodological problems within the framework of their subject.

The features of «Industry 4.0», as a defining factor in the modern society, have determined the main direction of modernization of higher pedagogical education. The training of a future teacher within the walls of the university should take into account exactly such approach. This has been reflected in the state compulsory educational standard for higher education of the last several generations. The graduate should be able to navigate in the changing information flow, select relevant pedagogical technologies and psychological approaches, apply relevant teaching materials, as well as have learning skills necessary for self continuation of further education in the studied area, as it is noted in the state compulsory educational standard, a consistent approach in the state compulsory educational standard of subsequent generations.

An organization of learners' educational research activity and development of its main component – research skills are one of the most essential conditions for improvement of effectiveness of the learning process. It helps learners to master the educational program (EP) successfully, and develops their logical thinking by creating internal motivation for study and professional activity.

Modern school teachers should be able to work in the context of updated content of education, with a variety of pedagogical approaches and teaching methods, with new textbooks and educational institutions of new type, and they should be able to adapt to pedagogical innovations. But formation of these skills is not always included in the university educational programs, and this process is often spontaneous.

For the higher school of the Republic of Kazakhstan, it is important to constantly improve the level of training of specialists that meet the needs of the labour market, due to their high professional and personal qualities. The major disciplines are aimed at training specialists with professional knowledge; they provide ample opportunities for subsequent purposeful and systematic self-education and effective pedagogical and scientific-pedagogical practice. Research skills should be part of the generalized professional skills of the teacher. School teachers-practitioners often cannot build their pedagogical activity on a research basis. Often the reasons for this lie in the fact that the university does not consider research skills and theoretical knowledge in this area as a priority. Students do not

realize the value of research activities and do not see the possibilities of its practical application.

This issue has a long history of development. The review and analysis of scientific, pedagogical and methodological literature have showed that future teachers' research activities were considered from different positions and points of view.

The issues of motivation and involvement of learners into the research activity, its psychological features are reflected by A.B. Brushlinski, L.S. Vygotsky, A.N. Leontiev, S.L. Rubinstein in their studies. The research works of M.A. Belialova, V.I. Zagviazinskii, N.L. Kalugin, A.I. Savenkov, A.D. Sydykbayeva are devoted to the realization of research approach in training of future teachers. The formation of educational research activities on physics are studied by V.A. Belianin, A.B. Usova, O.V. Fedina, E.A. Iaburova. The theory and methodology of practice-oriented teaching is reflected in studies of I.Iu. Kalugina, E.A. Sazanova. It should be noted the studies of A.Ye. Abylkassymova, Sh.T. Taubayeva, and N.D. Khmel, in which educational research activity is considered as a fundamentalization factor of training of future teacher for professional activity. These works cover a very important aspect of training of future teachers – the content, while another no less essential training aspect – the process is not considered sufficiently.

This was enough when the training of future specialists was connected with reproducing a set of ready knowledge and methods of activities. The updated content of secondary education has changed this situation and the emphasis has shifted towards learners' independence, high cognitive and creative activities.

The allocation of research skills into an independent (but in close connection with the educational material) object of assimilation requires from university teacher detailed analysis of the components of the educational process, understanding their interrelation and interdependence. The mastery of the system of subject skills is carried out using a number of mental operations, such as comparison, classification, analysis, synthesis, etc. They constitute a significant part of the learning process and should be in the field of vision of a university teacher, since the quality of the formation of mental operations depends on the success of future specialists in mastering not only subject knowledge, but also research skills. The totality of mental operations, their formation and development is an important link in the learning process.

The HEI and school as an employer are interested in clearly defined program of approved, sequential actions on training of competitive specialists.

Based on the analysis of the state of the theory and practice of this issue, we have established that nowadays there is **a contradiction** between the need for training of teachers who are ready for applying research skills in their professional practice and the capabilities of pedagogical HEIs to provide training of teachers with research skills.

This determined **a research problem** related to development of theoretical, and scientific and methodical basis for creation and implementation at a

pedagogical HEI a system of forming research skills of future teachers – Physics teachers based on a practice-oriented approach to teaching.

The relevance and validity of the issue has led to determine the topic of our study as «**Formation of research skills of future physics teachers in the context of a practice-oriented approach to teaching**».

Research object – a process of training of future Physics teachers at pedagogical HEI.

Research subject – the formation of future Physics teachers' research skills during studying physics of atom, atomic nuclei and solid.

Research aim – theoretical justification, development and practical implementation of formation of learners' research skills based on a practice-oriented approach to teaching.

Research hypothesis: the research skills of future Physics teachers in a pedagogical HEI can be formed, if in the process of a practice-oriented approach to teaching, the study of the physics of the atom, atomic nucleus and solid state provides a transition from reproductive activity to productive creative activity, then this will contribute to the purposeful and intensive development of the skills being formed.

In accordance with the research aim hypothesis the following **research objectives** are defined:

1. Justify the need for formation of future Physics teachers' research skills as a component of their professional activity.

2. Identify the essence of a practice-oriented teaching and its role in forming future Physics teachers' research skills.

3. Justify and develop a model for the formation of future Physics teachers' research skills.

4. Develop the basic theoretical and practical approaches to the methodology for the formation of research skills of future teachers on the basis of a practice-oriented approach during the study of physics of the atom, atomic nucleus and solid.

5. Show the effectiveness of the developed teaching methods and means for the formation of future Physics teachers' research skills in the context of implementation of a practice-oriented approach.

Research methods:

- analysis of psychological and pedagogical, scientific and methodical literature on the research topic;

- analysis of educational programs, catalogs of elective disciplines in terms of the possibility of forming learners' research skills;

- study and generalization of pedagogical experience, including personal experience of teaching at university in 2014-2019.

- observation, conversations, questioning, testing of learners;

- a pedagogical experiment;

- statistical processing of the results of the pedagogical experiment.

Theoretical and methodological basis of the research include:

- studies devoted to the justification of the effectiveness of the activity approach in education (S.L. Rubinshtein, A.N. Leontev, L.S. Vygotskii);
- theoretical basis of a practice-oriented teaching in a pedagogical education (A.B. Brushlinski, I.Iu. Kalugina);
- works devoted to the practical orientation of teaching Physics (V.G. Razumovskii, G.P. Stefanov, M.S. Moldabekova, V.N. Kosov);
- scientific and methodological foundations for the formation of educational skills (B.M. Bogoiavlenskii, A.V. Usova, etc.);
- psychological and pedagogical foundations of methodology of teaching Physics (V.A. Belianin, E.A. Iaburova, O.V. Fedina, L.M. Fridman, etc.).

The research base: the research and experiment have been conducted within Physics Department of the Institute of Mathematics, Physics and Informatics of Abai Kazakh National Pedagogical University.

Scientific novelty of the research is to justify the fact that the formation of the research skills of the learners of pedagogical HEIs is one of the main components of their professional training.

The following **scientific results** have been obtained during the research:

1. From modern scientific positions, the need for the formation of research skills of future Physics teachers, stimulating the development of cognitive activity and self-actualization of the individual, has been justified.

2. The essence of a practice-oriented teaching with the use of information and communication technology based on the study of atom, atomic nucleus and solid has been determined.

3. The structure of the model for the formation of research skills of future Physics teachers, reflecting research skills and including methodological, operational-activity and criterion-evaluative components, has been developed.

4. The efficiency of the practice-oriented approach in the methodology of the formation of research skills during the study of physics of the atom, atomic nucleus and solid is presented.

5. In a pedagogical experiment the effectiveness of the developed methodology for the formation of research skills by means of the learning discipline has been justified.

Practical significance of the research: the results of the study can be used by teachers of pedagogical HEIs, undergraduates, and learners during learning and in their further scientific and pedagogical activities.

The followings are offered for the defense:

1. Scientific and theoretical justification that the research activity and research skills are considered to be components of training of future teachers at pedagogical HEIs.

2. The practice-oriented teaching contributes to creating the research environment for formation of future Physics teachers' research skills.

3. The identified criteria characterize the level and dynamics of the formation of learners' research skills during studying physics of the atom, atomic nucleus and solid.

4. Specially developed system of laboratory works and research assignments serve as a mean for formation future Physics teachers' research skills during studying physics of atom, atomic nucleus and solid.

5. The results of a pedagogical experiment on the implementation of the teaching methods for the formation of research skills during studying physics of the atom, atomic nucleus and solid.

Validity and reliability of the main obtained results are provided by the analysis of the theoretical justification and practical implementation of teaching methods for formation of future Physics teachers' research skills during studying physics of atom, atomic nucleus and solid, generalization of research materials, and practical confirmation of theoretical principles in the practice of university training. The reliability of the author's developments is confirmed by the results of experiment and it is justified by compliance with the norms and rules of pedagogical research and statistically significant results.

Approbation of the research results has been carried out by participating in the regional, republic and international conferences, workshops, including 18 published works: in editions recommended by the Committee for control in the sphere of education and science of the Ministry of education and science of the Republic of Kazakhstan – 6; in Scopus indexed journals – 1; in Web of Science Core Collection indexed journals – 1; in proceedings of the international conferences – 6; in other publications – 2, Khirsh index – 1.

Some materials have been used in the development of the electronic resource; the implementation of the practical part of the study has been carried out during the author's work in Abai KazNPU (2014-2019), as well as by undergraduates and teachers who took part in the experiment.

Structure of the thesis: an introduction, two sections, a conclusion, references, a list of published works and appendices.

In the introduction the relevance of the research topic is justified, the research object and subject, and aim are defined, the hypothesis, main objectives, scientific novelty, methods of the research is formulated, theoretical and practical significance of the research, the provisions for defense are considered, an information about the research stages and results of its approbation are presented.

In the first chapter «**Theoretical foundations of the formation of research skills of future Physics teachers in the learning process at a pedagogical HEI**» based on the analysis of psychological, pedagogical and methodological literature on the problem of research, theoretical prerequisites for training of future teacher for research activities are considered. It is justified that research skills are an important component of the professional training of a future Physics teacher. The role of practice-oriented teaching in the formation of research skills is revealed, and the principles of selection of criteria for identifying the levels of formation of research skills of future Physics teachers are scientifically justified.

In the second chapter «**Methodology for the formation of research skills of future Physics teachers on the basis of a practice-oriented teaching**» the methodology for the formation and development of research skills during studying physics of atom, atomic nuclei and solid is given. The principles of selection and

design of a system of tasks (a system of specially selected tasks and laboratory work) aimed at realizing the research aim, are shown. The research results are presented, the effectiveness of the system of tasks and the methods of their use is proved.

In the **conclusion**, the main conclusions and results of the study are presented, possible prospects for the research are outlined.