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TÍTULO: Formación del profesorado en disciplinas científicas naturales en el contexto de la modernización de la educación en Kazajstán.

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RESUMEN: El artículo analiza requisitos que la modernización de la educación en Kazajstán impone para la formación de docentes en disciplinas científicas naturales en instituciones pedagógicas de educación superior en vista de las tendencias internacionales del mundo moderno. El hecho de que Kazajstán haya firmado la Declaración de Bolonia hizo que el país necesitara una modernización significativa del sistema educativo, incluida la educación pedagógica superior. El entorno moderno plantea nuevas metas y tareas; en particular, para la educación en ciencias naturales, brindando a cada estudiante la oportunidad de alcanzar el nivel de conocimiento requerido, representado por secciones sucesivamente relacionadas de disciplinas científicas naturales, incluida la integración con disciplinas metodológicas que mejorarán significativamente la calidad de la formación profesional de docentes.

PALABRAS CLAVES: Educación en ciencias naturales, contenido, sucesión, continuidad, metodología.

TITLE: Teacher training in natural scientific disciplines in the context of modernization of education in Kazakhstan.

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ABSTRACT: The article discusses the requirements that modernization of education in Kazakhstan makes for teacher training in natural scientific disciplines in pedagogical higher education institutions in view of international trends in the modern world. The fact that Kazakhstan signed the Bologna Declaration put the country in need of a significant modernization of the education system including higher pedagogical education. The modern environment poses new goals and tasks for school education; in particular, for natural science education, which should provide every student with the opportunity to achieve the required level of knowledge. It should be represented by successively related sections of natural scientific disciplines including the integration with methodological disciplines that will significantly improve the quality of professional teacher training.

KEY WORDS: Natural science education, content, succession, continuity, methodology.

INTRODUCTION.

The reform of the education system in the Republic of Kazakhstan is aimed at ensuring equal access to high-quality secondary education, protecting the rights and legitimate interests of children and forming an intellectually, physically, and spiritually developed and successful citizen with an innovative creative type of thinking.

Currently, this reform is carried out on the basis of the State Program for the Development of Education and Science of the Republic of Kazakhstan for 2016-2019. It touches on diverse aspects of human activities such as the development of state compulsory education standards at all levels of education, educational programs, curricula, updating the content of school education, and the development of new approaches to staff training (Government, 2018).

At each level of education, specific goals and objectives are highlighted along with the general focus of education on personality development. The tasks of updating the content of education are carried out within the framework of state compulsory education standards. The history of the development of the secondary education standards encompasses the activities aimed at their development and implementation in 1998, 2001, 2002, 2010, 2012, and 2016. Each standard had its own structural and content features and solved certain problems in view of the dynamics of the development of social phenomena and the educational system.

In accordance with the Kazakh Education Act of July 27, 2007 No. 319-III, state compulsory education standard of the Republic of Kazakhstan (hereinafter referred to as SCES of the RK) defines the combination of general requirements, according to an educational level, for

1) Educational content focusing on learning outcomes.

2) The maximum amount of learning time for students.

3) Training level of students.

4) Duration of study (Parliament, 2018).

Currently, the educational process in secondary schools in Kazakhstan is carried out in accordance with the state compulsory standard of secondary education (primary, basic secondary, and general secondary education) approved by the Decree of the Government of the Republic of Kazakhstan of August 23, 2012 No. 1080. The educational process has the following content features:

- A detailed description of the content of academic disciplines is not reflected, although the requirements for the content of education as a whole are defined.
- In order to move from a knowledge-centric to an activity-based model of learning, systemic activity-based and personality-based outcomes are specified in addition to content-based outcomes. This creates a condition for enhancing the practice-oriented education and the development of functional literacy of students via the implementation of a systemic activity approach.
- Concretization of the requirements for the training level of students in accordance with the studied materials and the definition of discipline-based knowledge, skills, personality-based, and systemic activity-based outcomes.
- The standard was intended to be a transitional stage from an 11-year school to a 12-year education implying a significant change in both its content and structural nature.
- Toughening requirements for maintaining the basic content of education and respecting the optimal ratio between invariant and variational components; the invariant component of the content of secondary education is implemented in standard curricula; the variational component is implemented in curricula of educational organizations.
- Systematization of the content of academic disciplines by enhancing inter-discipline integration and the redistribution of teaching materials according to educational level.
- Promotion of the Kazakh component and enhancement of educational potential.
- Exclusion of obsolete teaching materials and topics from the program and the implementation of new materials reflecting the modern socio-economic modernization of Kazakh society.

- Optimal distribution of time allocated for the study of academic discipline sections.

A standard curriculum for primary, basic secondary, and general secondary education is developed according to the language of instruction, learning level, and orientation. The academic disciplines of the invariant component remain unchanged in all standard curricula. This provides uniform requirements for the basic content of secondary education for all types of general educational organizations.

The creation of conditions for the implementation of level and orientational differentiation of education in two areas (social-humanities and natural-mathematical ones) promotes the value and activity components of the educational content, enhances its development and socializing potential. For the first time, requirements were established for the conditions of the educational process, financial support, logistics capacity, and the safety of life and the protection of the health of students.

This SCES of the RK eliminates the following shortcomings of the SCES of the RK of previous years:

- Unjustified removal of hours of a variational (that of school and student) component for the implementation of other disciplines (basics of religious studies, basics of economic literacy, etc.).
- Mismatch of the amount of learning time in the invariant and variational components in schools with Kazakh and Russian languages of instruction.
- Lack of opportunities for organizing an in-depth study of disciplines in general education organizations including gymnasiums and lyceums.
- The difference in the number of hours of the variational component of schools with Kazakh and Russian languages of instruction.
- Irrational distribution of hours for core disciplines of social-humanities and natural-mathematical areas.

- Violation of the structure of the standard curriculum (inclusion of the student component in the maximum academic amount learning time).

Over the past decade, the reforms of the education system in the Republic of Kazakhstan have been implemented with the aim of integrating it into the global educational space and further developing the entire education system in the republic.

The educational system of the country needs continued integration into the global educational space. In order to implement this priority, Kazakhstan has acceded to the main international agreements in the field of higher education including the Lisbon Recognition Convention (Convention on the Recognition of Qualifications concerning Higher Education in the European Region) (1997) and the Bologna Declaration (1999). In turn, the inclusion of Kazakhstan in the Bologna Process (2007) required the reform of the education system as a whole. In July 2012, at the III Conference of Education Ministers of the countries participating in the Bologna Process, Kazakhstan joined the Bucharest Communiqué of April 3, 2012 and committed to upgrade the qualifications of school graduates to the 4th level of the European Qualifications Framework.

According to the National Qualifications Framework of the Republic of Kazakhstan, Kazakh completed secondary education corresponds to level 3 of qualification. A prerequisite for continuing the implementation of the Bologna Process and the success of Kazakhstan in the international arena is the modernization of secondary education (Abylkassymova, Ryzhakov, & Shishov, 2017).

The main tasks of modern teaching are ensuring the continuity and succession of continuing education levels, the implementation of updated state compulsory standards of primary, basic secondary, and general secondary education approved by the Order of the Minister of Education and Science of the Republic of Kazakhstan of October 31, 2018 No. 604 into the educational process (Parliament, 2018).

Since the 2016-2017 academic year, the work on the implementation of updated content in school education in the Republic of Kazakhstan has begun (in 2016 for grade 1, in 2017 for 2, 5, and 7 grades, in 2018 for 3, 6, and 8 grades, in 2019 for 4, 9, and 10 grades). This work is aimed at ensuring equal access to high-quality secondary education and enhancing the educational component in view of the spiritual and moral values of the "Mäñgilik El" national-patriotic idea and the "Rwxanï jañğırw" program. The gradual transition to the criteria-based grading system for students and organization of education in accordance with the scheme of transition to updated educational content (Government, 2018).

State compulsory standards of secondary education with updated content are focused on the best international experience in developing a wide range of skills, the totality of which ensures functional literacy.

The updated SCES is focused on building a model of education based on outcomes enabling to evaluate student work and achievements. The wording of the expected results will make it possible to objectively evaluate the educational achievements of students, determine the individual development path of each student when taking into account his/her individual abilities, as well as increase their motivation for the development of functional literacy, skills in teaching, and improve the quality of the educational process (Ryzhakov, Abylkassymova, & Shishov, 2018).

At the center of this new model of education is the development of functional literacy among schoolchildren, creative skills of independent search, critical analysis and evaluation, as well as initiative and the ability to find innovative solutions. All these functional skills are formed in the school (Abylkassymova, & Tuyakov, 2018).

In the updated curricula of secondary education, the expected results are formulated as a system of learning objectives that serve as the basis for determining the content of a discipline. A well-organized system of learning goals is the basis for the development of the following skills of a wide

range: functional and creative application of knowledge, critical thinking, research, the use of information and communication technologies, the use of various communication methods, the ability to work in a group and individually, solving problems and making decisions.

The content of the daily educational process in a particular discipline is subordinate to the learning objectives and is focused on the formation of students' willingness to use the acquired knowledge and skills creatively in any educational and life situation, the development of perseverance in achieving success, motivates learning throughout life. The curriculum of each discipline provides for the implementation of trilingual education that involves not only three languages learning but also the organization of extracurricular activities of students in three languages (Kazakh, Russian and English). A criteria system in the form of formative and summative assessment has been implemented.

The content update of school natural science education is associated with modern requirements imposed on the knowledge of students. The main goal of school science education is to develop functional literacy that implies the ability of a student to use the knowledge acquired during school to solve various tasks with inter-disciplinary and practice-oriented content for the continued education and successful socialization.

The basic principle of the updated content of science education includes:

- The creation of a humane educational environment that stimulates the development of moral and spiritual qualities of an individual.
- Achieving a high level of moral and spiritual culture in educational organizations and families.
- Development of logical thinking among students.
- Enhancement of the applied component of natural scientific disciplines (mathematics, physics, chemistry, biology).

- Development of mathematical literacy and mathematical language to reason logically, use mathematical concepts in various situations, learn to speak, write, understand, apply, analyze, and evaluate correctly.

- Development of functional literacy among students.

- The formation of students' spiritual, moral and intellectual qualities, etc. (Abylkassymova, 2018; Abylkassymova, Kalney, & Shishov, 2018).

The principle of priority of the development function in teaching natural science comes to the fore as a fundamental principle of the content update of school science education in the aspect of "discipline for the student". The development of Kazakh students will also take place via the implementation of active forms of learning, during which it is assumed that students will develop functional literacy independently, will acquire knowledge actively, and will be creative in solving problems.

A key figure in the quality education of schoolchildren is a modern teacher with sufficient fundamental and applied knowledge; that is why, pedagogical education in higher education institutions should be called upon to train future teachers in the necessary apparatus used in various fields of knowledge, equip them with a system of different methods of understanding the reality and provide the awareness of the scientific foundations of school subjects.

The training of future teachers should be focused on the modern school, on the changes taking place in it. University graduates in pedagogical specialties should have a deep knowledge of the content of subjects studied in secondary education organizations. It is very important to understand the need to ensure the continuity of educational programs of higher pedagogical and general secondary education in the context of educational content update (Shuinshina, Kopeyev, Tuyakov, & Mubarakov, 2019).

The content update of school education in the Republic of Kazakhstan sets itself the main goal - improving the vocational and methodological training of future teachers in pedagogical higher educational institutions in the context of updating the educational program of higher education.

At the present stage of modernization of the Kazakh system of education and science, universities are vested with the authority to develop educational programs independently with a focus on the labor market. The academic freedom of universities in determining the content of educational programs has been increased to 55% in undergraduate studies. Therefore, today universities have the opportunity to improve educational programs when taking into account the wishes of employers and the requirements of modern society.

In accordance with the Kazakh Education Act of July 27, 2007 No. 319-III, the content of educational programs of higher education provides for the study of the cycle of general education disciplines, the cycle of basic disciplines, the cycle of majors, as well as professional practice in the relevant areas of training with a focus on learning outcomes and compliance with the national qualifications framework and industry qualifications frameworks. In the framework of the component of choice, the student, when determining the individual learning path, can choose:

1) Disciplines in the main educational program.

2) Disciplines for an additional educational program. The schedule and workload for mastering the disciplines in the main and additional educational programs are established by the rules of the organization of the educational process according to course credit system (Parliament, 2018).

The methodological basis for the design of educational programs are the principles, methods and procedures for developing educational programs.

The content and structure of educational programs comply with state compulsory standards of higher and postgraduate education (approved by the Order of the Ministry of Education and Science

of the Republic of Kazakhstan of October 31, 2018 No. 604) and are implemented via curricula common for all forms of training.

In order to ensure continuity and increase the effectiveness of learning outcomes in higher education institutions, an integrated approach is used. It is based on the modular principle of the formation of educational programs, and, accordingly, curricula at all levels of education.

Within the framework of the specialties of higher and postgraduate education, educational programs are coordinated with the Dublin descriptors and the European Qualifications Framework and are developed in accordance with the National Qualifications Framework and professional standards.

Therefore, today the issue of the coherence and interconnectedness of the educational standards of the school and the university is becoming urgent since the general orientation of specialist training, the similarity of general professional training inherent to a single-discipline group of specialties and the commonality of general professional and special training carried out in general disciplines and educational elements of discipline programs are emerging in the educational space.

DEVELOPMENT.

The current stage of the functioning of various types of organizations of general secondary education and the introduction of an updated content of education poses new challenges for school science education, as well as puts forward increased requirements for professionally oriented teacher training in natural scientific disciplines.

In order to solve the problems posed to the updated content of school education and to the natural science education in the secondary education system, it is necessary to equip future teachers of natural sciences with basic (key) knowledge and skills that accelerate the process of their professional development.

The necessary professional and methodological teacher training implies not only a teacher's deep and solid knowledge of all program sections of a school course including in-depth study and specialization but also a high knowledge of the teaching methodology of the subject, knowledge of the methodological features and specifics of teaching the subject.

The cultivation teachers' national and universal values, their preparation in higher pedagogical institutions for the subsequent educational process, and their professional and methodological training according to modern requirements are the main tasks assigned to the system of higher and postgraduate education by the state development program of the education and science of the Republic of Kazakhstan for 2016-2019 (Government, 2018).

Professional and methodological training of a future teacher is understood as acquired knowledge, skills and abilities in the field of a consciously chosen pedagogical profession before pedagogical activities, personal qualities, the ability to prove oneself the desire to improve professional capabilities constantly (Abylkassymova, 2015).

The methodological teacher training in natural scientific disciplines at a pedagogical university is a purposefully organized systematic training that provides future teachers with the development of theoretical foundations, methodological knowledge, professional and practical ways of implementing the learning process in mathematics, physics, chemistry and biology for students in the developing system of secondary general and professional school.

The main types of professional and methodological activities are associated, first of all, with the ability to study the educational, methodological, scientific, and pedagogical literature within a specialty area and to design the teaching process, to improve the efficiency of lessons. It is also associated with analytical and synthetic activities for the implementation of the logical-mathematical, logical-didactic, and methodical analysis of the educational content; with planning the educational process at a holistic level.

An effective teacher training in the system of higher pedagogical education presupposes the orientation of the methodological teacher training in scientific disciplines to create conditions for students to master the updated content of school science education and to familiarize them with the main types of professional and methodological activities in mathematics, physics, chemistry, and biology.

To do this, it is necessary to determine the following general methodological skills that need to be formed among future teachers of natural scientific disciplines:

- Knowledge and ability to apply scientific methods in the lessons such as analysis of a lesson material from a methodological point of view, synthesis, abstraction, generalization, comparison, juxtaposition, induction, deduction, and observation.
- Ability to analyze the basic concepts, the content of topics and the logical structure of the course.
- Ability to select a rigorous scientific style of presentation of new material correctly.
- Ability to train students to work with the textbook.
- Ability to anticipate students' possible difficulties when they study a specific topic and to organize the elimination of such difficulties.
- Ability to highlight and systematize the important things in the material under studies.
- Ability to classify educational tasks selected for the solution in the lesson (Abylkassymova, 2015).

The conducted analysis makes it possible to put forward the following requirements for the teacher training in natural scientific disciplines in the higher pedagogical education system:

a) The theoretical and methodological teacher training in natural scientific disciplines should educate a modern creative-minded teacher armed with methodological and fundamental knowledge in the discipline, the basics of psychological and pedagogical sciences, teaching methods, and advanced pedagogical experience.

b) The educational process necessary for the formation of professional and methodological activities of future teachers should be directed to the democratization, humanization, differentiation to create the conditions for:

1) The intellectual development of the future teacher of mathematics, physics, chemistry, and biology.

2) Creative activity, cognitive independence of students during the acquisition of theoretical knowledge and their synthesis ensuring their readiness for future professional activities.

3) Intensification of the process of teacher training in natural scientific disciplines by enhancing the continuity between academic and research activities that involves revealing students' readiness for educational research and scientific activities, developing their creative activity, independence and responsibility.

In addition, an analysis of the theoretical foundations of various conceptual models of teacher training in a pedagogical university allowed us to formulate the following general creative principles of teacher training in natural sciences for future activities:

a) Humanization requiring recognition of the personality of each student as a subject of creative work, knowledge, and communication.

b) Integrity, i.e. methodological teacher training as a holistic system in the professional education: a high level of development; the perfection of methodological training (possibilities of forming the creative personality, the realization of continuity between various types of activity in learning); certain qualitative completeness, internal unity of the components and elements of professional training.

c) Fundamentality involving the formation of professional and methodological knowledge and skills.

d) Unity of subject, professional, practical and methodological training ensuring the effectiveness of the functioning of the system of methodological teacher training in natural scientific disciplines.

e) Continuity of comprehension of professional and methodological activities in the learning process.

f) Context of training requiring the consideration of the relationship between the educational and future professional activities of students.

g) Activity, initiative and creativity of students when learning that orient the activities of the teacher to the search for effective ways to develop the general and professional abilities of each student in view of their interests, motives, and values.

h) Universality that implies the formation of real opportunities for future teachers to work both in secondary schools and in specialized schools with in-depth study of mathematics, physics, chemistry, and biology such as lyceums, gymnasiums, etc.

i) Prospect of the possibility of using a model of the system of methodological teacher training for the improvement of this training in similar studies, and its modernization without significant restructuring.

At present, universities and pedagogical educational institutions are engaged in teacher training, in particular, natural science teachers, in Kazakhstan. At the same time, the most widespread form of teacher training is still training at pedagogical institutes. However, not all pedagogical universities of the country have a balanced content of natural science programs in relation to an updated secondary education program. Therefore, discipline teaching methodology is poorly correlated.

The general development orientation of the system of methodological teaching training in natural sciences in universities should be brought into line with the updated content of science education in secondary schools.

Students-trainees and graduates of pedagogical universities encounter a number of difficulties in applying the appropriate methodology to various situations in teaching a subject in a modern school (in particular, in differentiating students by their giftedness and level). They do not master enough the skills of designing modern lessons, i.e. natural science content. The implementation of updated educational content and innovative methods in the educational process requires them to be particularly active and prepared. Graduate students, when emphasizing the importance of both fundamental and professional-methodological training, especially emphasize the importance of knowledge of the psychological aspects of teaching the subject, ways, and methods of presenting new material and solving problems, organizing educational and cognitive activities of schoolchildren in the classroom.

The content update of school science education requires, first of all, bringing its goals, content, and technology in line with the needs of society and the modern school, improving educational programs, educational and methodological complexes in the subject, forms and methods of teaching it. This, in turn, provides for the improvement of the university course teaching methods of mathematics, physics, chemistry and biology, as well as forms, methods and means of classes that students must learn in addition to the search for effective ways to improve the professional and methodological teaching training in natural scientific disciplines at the university.

Initially, the content of science education in teacher training universities should be aimed at implementing the principle of continuity, succession, and professional orientation when studying a course in mathematics, physics, chemistry, and biology. Successively related sections of disciplines including integration with methodological disciplines will significantly improve the quality of professional teacher training in natural scientific disciplines. The quality of schoolchildren's education, and hence the future of science education, depends on the quality of graduate training at a pedagogical university; for example, a full-fledged education of a future mathematics teacher is

impossible without well-established methodological training, and the teaching of mathematics at school itself requires the formation of the methodological thinking of students and is universally recognized.

Methodological training includes training via the implementation of the methodological line in teaching mathematical disciplines; subjects of the methodological cycle provided for by the curriculum; special courses (a variety of special courses on various topics including integrative and elective ones); organizational forms (term papers, diploma thesis, independent and individual work, and teaching practicum) and control systems (midterm control and exam). All this creates a system of methodological teacher training in mathematics at a pedagogical university.

What is important is the need to implement a larger number of elective courses into the educational programs for in-depth study of school mathematics such as combined mathematical courses (algebra, number theory, mathematical analysis, function theory, geometry, etc.) with sections of elementary mathematics, basics of probability theory, number systems, history of mathematics, elements of mathematical statistics and the cycle of educational and methodological disciplines that provide training for mathematics teachers. This, on the one hand, will make it possible to fill in the gaps of school and university courses in mathematics, and on the other hand, it will enhance the mathematical teacher training in the context of differentiation of both types of educational organization and specialty differentiation of education (Abylkassymova, & Zhumagulova, 2016).

In the course of the analysis of educational programs of pedagogical universities in Kazakhstan, it was revealed that changes in the curricula of secondary education were not taken into account in the existing educational programs. The lack of continuity in the content of educational programs of general secondary and higher education for teacher training creates problems that affect the quality of the education system as a whole. In addition, the mathematical disciplines available in the educational program were slightly adjusted with the content of school mathematical education. The

programs of the mathematical and professional cycles of the disciplines of the curriculum at junior courses of pedagogical universities should be aimed at implementing the principle of continuity of mathematical education so that students have the opportunity to adjust and generalize their basic knowledge of school mathematics at a higher quality level. Courses such as Elementary Mathematics, Fundamentals of the School Mathematics Course, etc., studied in the first courses, were to become a link between the school and the university, fill in the gaps in students' knowledge, consolidate and systematize students' knowledge related to their future profession.

Therefore, under the guidance of a Doctor in Pedagogical Sciences, Professor, Corresponding member of the National Academy of Sciences of the Republic of Kazakhstan, Head of the department of methods of teaching mathematics, physics and computer science of the Abai Kazakh National Pedagogical University, A.E. Abylkassymova (2018a), an educational program of the specialty "5B010900 - Mathematics" was developed.

In accordance with the state compulsory standard of higher education, the educational program contains:

- Theoretical training including the study of the cycle of general education, basic and core disciplines, various types of professional practices, physical education, military training, etc.
- Additional types of training.
- Intermediate and final certification.

The educational program includes a modular curriculum, documentation of educational programs, a catalog of elective disciplines, and practicum programs.

In addition to the educational program, the Catalog of Elective Disciplines (CED) has been developed. This provides university students with the opportunity of an alternative choice of elective academic disciplines. The list of component disciplines is optionally determined in accordance with the requests of employers and the needs of the labor market.

The educational program is built on the principle of modular training, the logical sequence of studying disciplines and accounting for prerequisites. By agreement with the Republican Training Council of the Ministry of Education and Science of the Republic of Kazakhstan, the educational program includes a number of disciplines (from 1 to 4 courses) including elementary mathematics (arithmetic, algebra, and geometry).

Curricula such as elementary mathematics (arithmetic, algebra, and geometry), the scientific foundations of the school course in mathematics, methods for solving non-standard problems in mathematics, specialty and level differentiation of teaching mathematics have been implemented for teacher training. The basis for the construction of these courses is the main content of the school course in mathematics (sets and operations with them; expressions and their transformations; functions, their properties and graphs; equations and inequalities, and their systems; geometric shapes, their properties and measurement; elements of mathematical analysis; elements of mathematical statistics and the foundations of probability theory).

A sufficient number of hours (3-4 credits for each one) were allocated for their study. All of the above made it possible not only to fill the gaps in the students' knowledge but also to help consolidate and systematize the existing students' knowledge taken from school and university sections of mathematics with an orientation to the future profession of a teacher of mathematics.

When taking into account the continuity of the updated content of secondary education and Dublin descriptors in the educational program, the following five main learning outcomes are identified: 1) knowledge and understanding; 2) the application of knowledge and understanding; 3) the formation of judgments; 4) communication skills; 5) learning skills or ability to learn.

The enhancement of the professional and methodological teacher training in mathematics can be facilitated by special seminars and special courses dedicated to the method of teaching mathematics, completing term papers and diploma theses on the method of teaching mathematics.

Moreover, the subject matter of special courses, special seminars, term papers, and theses should orient future mathematics teachers to work in classes in secondary schools.

The authors' rich experience in a teacher training higher education institution shows that the training in mathematical disciplines has to be correlated with the methodology of teaching mathematics. Therefore, in order to train a professional mathematics teacher, the balance between the specialized mathematical training and methodological one is necessary. In this regard, the professionally-oriented mathematical education should start from first years of study in a higher education institution, and then, it should be studied more deeply when attending methodological courses such as "Methodological foundations of mathematical problem solution," "Theory and methods of teaching mathematics," "Practical methodology of teaching mathematics," "Methodological foundations of differentiated mathematics teaching at school," "Organization of mathematics teaching. Modern lesson," "History of mathematics," etc. (Figure 1) (Abylkassymova, 2018b).

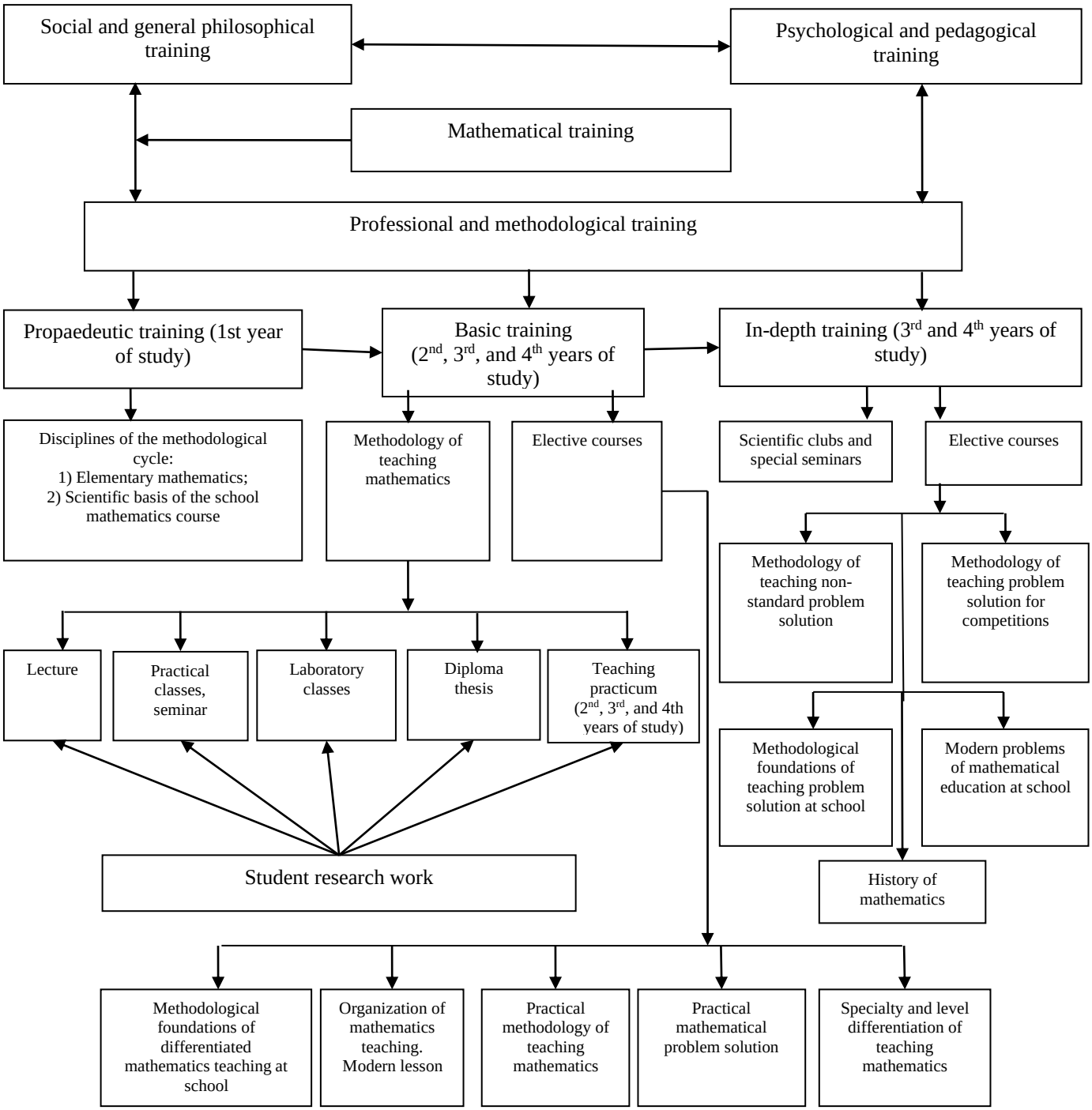

Figure 1. System of methodological teacher training at a pedagogical university. **Source**: compiled by the authors.

The course entitled “Theory and methods of teaching mathematics” occupies a central place in the methodological teacher training in mathematics. This course is intended to form the need for future teachers to enhance knowledge systems, both in mathematics and in teaching mathematics since the study of this subject involves the integration of knowledge obtained from different fields, and, above all, discipline-based and psychological-pedagogical ones. Therefore, this course ensures the fundamentalization of the methodological teacher training in mathematics in the system of higher pedagogical education.

In addition, except for the "Theory and Methods of Teaching Mathematics" course, the methodological teacher training in mathematics is carried out, according to the updated content of school education, on the elective courses such as "Practical methodology of teaching mathematics," "Methodological foundations of mathematical problem solution," "Organization of mathematics teaching. Modern lesson," special seminars, during teaching practicum, and while preparing a thesis on the methodology of teaching mathematics. This approach helps future mathematics teachers to absorb all the knowledge they have acquired at university, both in the field of school and university mathematics, as well as in pedagogy, psychology, and methodology of teaching other disciplines. This will ultimately provide students with the development of the basic types of pedagogical activity that they will perform in practice.

Professor A. Abylkassymova proposed one of the possible options for constructing a course on the methodology of teaching mathematics at a pedagogical university in textbooks for students of pedagogical universities such as “Theory and Methods of Teaching Mathematics: Didactic and Methodological Aspect” (in Kazakh, Russian and English), “Modern Lesson” (in Kazakh and Russian languages), "Methodological foundations of teaching problem solution at school" (in Kazakh and Russian). These teaching aids are used in the educational processes of universities and pedagogical educational institutions of Kazakhstan and give the necessary positive results in the

mathematical and methodological training of university graduates (Abylkassymova, 2014; Abylkassymova, Tuyakov, & Zhumaliyeva, 2018).

Literature review.

A review and analysis of scientific sources on the topic under study have led many scientists in their studies to consider promising areas for the development of teacher education and to highlight various problems of professional and methodological teacher training in higher education (Shuinshina, Tuyakov, Alpeissov, Zhanseitova, & Ardabayeva, 2018).

K. Kusherbayev and A. Abylkassymova analyze the state and development trends of higher education, views on its role and significance, content, organization, and dissemination of research results in order to develop a strategy for the development of higher education, improve its quality and management efficiency.

The strategic areas of modernization of teacher education in the context of innovative development are reflected in the works of A. Abylkassymova, M. Ryzhakov and S. Shishov (2015a; 2015b; 2017).

Various aspects of the professional education of teaching staff are studied. A. Abylkassymova, A. Beysenbayeva, T. Kenzhebayeva, L. Mazhitova, E. Mambetakunov, G.A.Umanov, and N. Khmel are engaged in the psychological and pedagogical aspects of this problem.

The Kazakh methodologists (A. Abylkassymova, A. Kubesov, D. Rakhymbek, A. Kenesh, A. Kagazbayeva, N. Akhmetov, S. Maussymbayev, et al.) studied the problems of developing the scientific foundations of the methodological teacher training in natural scientific disciplines. The scientists from the CIS countries (I. Bekboyev, V. Gusev, Z. Ikramov, Y. Kolyagin, V. Krupich, G. Lukankin, Y. Lyashchenko, V. Mishin, I. Novik, V. Oganesyan, G. Sarantsev, Z. Slepkan, A. Stolyar, E. Mambetakunov, et al.) also studied these problems (Abylkassymova, 2018a;

Abylkassymova, Kalney, & Shishov, 2018; Rakhymbek, 1998; Kagazbayeva, 1999; Akhmetov, 1995; Maussymbayev, 2005; Mambetakunov, 2015).

A special role in teacher training in a pedagogical university is given to methodological training. A. Mordkovich, I. Novik, A. Abylkassymova, A. Kagazbayeva, N. Stefanova, O. Ivanov, Y. Silayev, D. Baysalov, D. Rakhymbek, E. Mambetakunov, N. Akhmetov, K. Aymaganbetov, S. Maussymbayev studied the problems of special teacher training in pedagogical universities (Mordkovich, 1986; Abylkassymova, 1995; Stefanova, 1996).

A. Mordkovich (1986) offers the concept of the professional pedagogical orientation of mathematics teacher training. I. Novik developed the theoretical position of building a system of methodological teacher training in a pedagogical university based on the formation of a methodological culture. A. Abylkassymova (1995) considers the problem of the development of activity and independent cognitive activity of a mathematics teacher in the system of methodological teacher training in mathematics at the university.

The perfection of professional and methodological teacher training in mathematics in the system of higher pedagogical education is devoted to the doctoral research of A. Kagazbayeva (1999). N.L. Stefanova (1996) considered the development of the system of methodological teacher training in mathematics based on the integrative principle of constructing the content of this training. The problems of teaching physics in higher pedagogical educational institutions are the subject of research by E. Mambetakunov (2015). N. Akhmetov (1995) addresses issues of theory and practice of game education in teacher training. The theory and practice of professional teacher training in natural sciences at the university are reflected in the doctoral dissertation of S. Maussymbayev (2005).

An analysis of the works of these authors, as well as scientific and methodological literature, enables concluding that they examined and resolved important issues of professional and methodological teacher training in natural sciences related to the theoretical justification of the essence and structure of the system of methodological teacher training. They revealed the principles of its development, the development of various models of the content of the methodological teacher training in the system of higher pedagogical education (Shuinshina, Alpeisov, Burunbetova, & Zhakupov, 2018; Shuinshina, Alpeisov, Akhmetova, & Tuyakov, 2019).

The particular didactic problems of teacher training in the context of content update of school education in the Republic of Kazakhstan, both theoretically and in practical terms, are still insufficiently studied.

CONCLUSIONS.

The issues of methodological teacher training in natural sciences, in the system of higher pedagogical education should constantly be in the field of view of teachers of special natural sciences. Methodological training is designed to provide future teachers with the ability to consider not individual facts of the discipline but to acquire skills to consider the discipline in general, i.e. in its methodological and logical connection.

Educational programs for teacher training in natural sciences are updated in the context of the competency-based model and forms of education in accordance with the state general compulsory standard of higher education, credit amount, and discipline cycles (general education, basic, and core ones).

There are competencies related to the content area and general ones. Competencies, when formulated concisely and clearly, reflect the ability of students to demonstrate knowledge, understanding, and skills, i.e. what they learned.

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