on the dissertation work for degree of Doctor of Philosophy (PhD) in specialty 6D010900 – Mathematics Bekish Ulan Abdilkailuly on the theme «Methodology of development of meaningful components of elective courses of mathematical profile in higher educational institutions" (on the example of the course "Singularly offset common edge tasks with boundary surges for ordinary differential equations")»

ANNOTATION

Relevance of a research. Globalization of the economy and society, informatization of all processes of modern organization of production, modernization and development of the world educational space make it necessary to update the content of the educational program, to improve the quality of the scientific and educational environment of our country.

On the other hand, in the world educational space and in the Republic of Kazakhstan, higher educational institutions and employers are given greater autonomy in the development and implementation of educational programs.

At the same time, informed selection of educational disciplines, as well as careful development of the content of educational materials, content components of relevant educational disciplines, occupies an important place in the implementation of educational programs.

Since the proposed subjects and their contents should ensure: a high level of education corresponding to the world level; formation of professional competence of future specialists, corresponding to the needs of society, level of modern scientific research. This raises questions of developing requirements for university textbooks and tutorials.

However, practice shows that today the problems of designing the content of textbooks and teaching aids in higher education institutions of our country are mainly limited to the following activities: formal selection of the content of educational materials, provided for in the work plan; application of traditional teaching methods to the presentation of educational materials.

It seems that the educational activity of our universities is limited to the implementation of these issues only.

Practice has shown that the educational material of elective disciplines should contain more modern, relevant material in the context of fundamental knowledge set out in the educational program.

Problems of education and content of educational disciplines are reflected in many domestic and foreign studies, for example in works Y.K. Babanskiy, M.V. Pototsky, N.A. Galatenko and I.I. Ilyasova, V.V. Kraevsky, V.S. Ledneva, I.Y. Lerner, V.M. Rozina, A.E. Abylkasymova, A.K. Kagazbayeva, Michelle Stephan, Cyril Julie, Fou-Lai Lin, Minoru Ohtani and others.

The development of a modern textbook for general education schools of the Republic of Kazakhstan is described in [1].

However, they do not adequately address the design of content components of elective disciplines, including the design of content of mathematical subjects in

higher pedagogical education and the formation of professional knowledge and skills through content components of elective disciplines.

Scientific and pedagogical literature outlines scientific-theoretical and practical prerequisites for teaching students - future teachers of mathematics to work with some components of the content of educational material

(A.A. Stolyar, A.G. Mordkovich, A.I. Mostovoy, N.S. Dalinger, V.A. Gusev, N.S. Antonov, G. I. Sarantsev, L.T. Iskakova, E.Zh. Smagulov, S. M. Seitova, etc.).

However, there remains little research in the scientific literature on the development and targeted use of the content components of elective disciplines, taking into account the holistic representation of the issues of students learning of the content of educational material and the methodology of its teaching.

In turn the training is based on the content of the educational material of disciplines, the transmission of the logic of this material.

Taking this factor into account in education is insufficient in the successful formation of professional knowledge and skills of students. Practice shows that in training it is necessary to take into account the influence of psychological and pedagogical factors, methods of presentation of educational materials.

Not taking these factors into account would mean excluding learning material from consideration.

And it from the psychological and pedagogical point of view would be wrong.

Thus, questions of mathematical science and psychological and pedagogical questions of the student and the teacher are intertwined in one bundle.

However, in the universities of Kazakhstan the design of the content of any elective course is mainly carried out, without taking into account the processes of learning the educational material, the logic of course construction, the modern state of the content of science, the requirements of modern didactics.

In this regard, it is necessary to consider the problems of designing content components, developing scientific materials taking into account these processes, issues of teaching students the content of scientific (educational) material through content components of elective disciplines.

Thus, the study of the problems of assimilation of educational materials and the development of content components of elective disciplines has revealed a number of *contradictions:*

- between the assertion of the content of elective disciplines as the main component in the process of higher education and the lack of research into the problem of developing requirements for the content of mathematical disciplines in higher education institutions;

- between the requirements of the State department of higher vocational education, which determine professional knowledge and skills of the future teacher of mathematics and the lack of scientific and methodological means that lead to the successful formation of these knowledge and skills;

- between the basic need for learning practice in ensuring students successful learning of scientific (educational) material of higher mathematics and the lack of

development of meaningful components of elective disciplines ensuring effective learning of these educational materials.

The above contradictions determine *the problem of research,* which consists in the lack of elaboration of requirements to the content of elective disciplines aimed at the successful formation of professional knowledge and skills of future teachers of mathematics.

The relevance of this research problem in higher education was the basis for choosing the topic of the study: "Methodology of development of meaningful components of elective courses of mathematical profile in higher educational institutions" (on the example of the course "Singularly offset common edge tasks with boundary surges for ordinary differential equations").

The aim of the study is to provide a scientific basis for the methodology of developing the content components of the elective disciplines of mathematical profile in higher pedagogical educational institutions (on the example of the elective discipline "Singularly offset common boundary tasks with boundary surges for ordinary differential equations").

Research object: educational and methodical process to prepare elective disciplines for future mathematics teachers

The subject of the study: the methodology of development of meaningful components of elective disciplines.

Hypothesis of a dissertation research: if you supplement the contents of existing elective disciplines with developed content components of certain species:

- Control component;
- Scientific knowledge component;
- Cognitive and activity component;
- Estimated component;
- Backbone component;

and recommendations for their use and, to apply an augmented system of meaningful components in the education of students, it will allow to successfully form professional knowledge and skills in future teachers of mathematics at a higher level.

Research problems:

- conduct an analysis of philosophical, psychological and scientific-pedagogical literature in order to identify design problems and develop the content of selective courses in the system of higher pedagogical education;
- to reveal psychological and pedagogical factors of mastering by students of the content of educational (scientific) material at studying of elective disciplines, to define theoretical bases of designing of the content of educational materials;
- to determine the basic requirements for designing the content of educational material of elective disciplines, taking into account these requirements to create a new scientific material for the elective course;
- develop meaningful components of elective courses based on the requirements for the content of the elective course, principles and criteria of pedagogical didactics that complement the existing system of meaningful components of mathematical disciplines;

- to create a methodology of design and use of content components, to justify the possibility of realization of their main functions for formation of professional qualities of students - future teachers of mathematics.

The following approaches formed the theoretical and methodological basis of the study:

- systematic approach to formation of professional and methodological competence in pedagogical university (I.A. Zimnaya, A. G. Bermus, V. I. Baydenko, L. D. Davydov, E. Y. Kogan, D. A. Ivanov, K. G. Mitrofanov, O. V. Sokolova,

V. G. Afanasyeva, A. G. Kuznetsova, V. P. Bespalko, N. F. Radionova, Y. A. Urmantsev, E. G. Yudin, E. F. Zeer, A.V. Khutorsky, etc.);

- basic principles and criteria of training (Y. K. Babansky, V. A. Gusev, N. I. Boldyrev, G. V. Dorofeev, N. K. Goncharov, O. B. Episheva, B. P. Esipov, T. A. Ilyina, S. E. Lyapin, M. N. Skatkin, etc.);

- basics of designing training content (Y. K. Babansky, M. M. Potashnik, Heather C. Hill, Merrie L. Blunk, N. A. Galatenko, I. I. Ilyasov, V.V. Kraevsky, B.C. Lednev, I. Y. Lerner, V. M. Rozin, A.E. Abylkasymova, A.K. Kagazbayeva, Michelle Stephan, Cyril Julie, Fou-Lai Lin, Minoru Ohtani and others).

- problems of developing the content of the discipline (M.V. Pototsky, V.M. Monakhov, M.N. Skatkin, I.Y. Lerner, N.F. Talyzina, V.A. Testov, G.G. Hamov et al.);

- theoretical researches of problems of professional training of the future teacher of mathematics (I.V. Ammosova, A.B. Koganov, G.N. Gubaidullina, V.I. Igoshin, A.A. Stolyar, A.U. Dauletkulova et al.).

- approaches to formation of thinking abilities, autonomy in learning material and activation of cognitive activity (Y. K. Babansky, N.Y. Vilenkin, I.A. Zimnaya, I.Y. Lerner, A.I. Bloch, L.M. Fridman and others);

Research methods:

a) theoretical: analysis of scientific literature on the topic of research; the analysis of provisions, the normative documents relating to process of training and a problem of a research; study of pedagogical experience of mathematics teachers;

b) empirical: interviews with teachers, students, masters and school teachers; questionnaire of teachers, students, masters and young teachers; written works of students and their analysis; pedagogical experiment;

v) processing and analysis of experimental data using statistical research methods.

The experimental study was conducted from 2016 to 2019 year in the usual conditions of the educational process of Zhetysu state university named after I. Zhansugurov and the Women's state pedagogical university in the context of learning the mathematical content of elective disciplines according to the objectives of the study and consisted of three stages.

At the first stage, a statement experiment was carried out (2016-2017 year), which was to identify the lack of development of meaningful components of elective disciplines in the context of increasing the level of readiness of future mathematics teachers for professional activities. At this stage, based on the analysis and comparison of psychological, pedagogical, philosophical, scientific, methodological

and mathematical literature on the topic of research, experimental work, the degree of development of the research problem in pedagogical theory and practice was revealed; the object, subject, goal and objectives of the study are determined, the hypothesis of the study is formulated.

At the second stage, a search experiment was carried out (2017-2018 year).

At this stage, in order to design the content components of elective disciplines, interviews and questionnaires were conducted.

The analysis of the answers to the questions of the questionnaires revealed the direction of development and addition of content components, which would allow students - future teachers of mathematics to study scientific (educational) materials independently and the need of students to use content components.

In the course of the pilot study, scientific knowledge and tasks were selected and tested, which would allow to change and supplement educational and methodological support of selective disciplines.

At this stage theoretical basis of design of content components of elective courses in higher mathematics of pedagogical profile was revealed, content components of elective courses were developed and classified, requirements of design of educational materials of elective disciplines, method of formation of professional knowledge and skills of future teachers of mathematicians in the process of study of elective disciplines were developed and supplemented.

The final stage of the research was the forming experiment (2018-2019 year), the main purpose of which was to identify the effectiveness of the developed system of content components of elective disciplines in the process of teaching the student the scientific content of elective discipline.

The essence of the forming experiment was the introduction of the developed system of content components of elective disciplines and the method of its use in learning the scientific content of educational material.

During the experimental study, the study of the discipline "Singularly offset common edge tasks with boundary surges for ordinary differential equations" in the control group took place without making certain changes to the content of the educational material, as well as to the process and methods of training.

In the experimental group, the process of teaching elective discipline "Singularly repaid common edge tasks with boundary surges for ordinary differential equations" implemented the authors idea aimed at forming professional knowledge and skills through the developed content components of elective disciplines.

At the final stage of the study, in order to determine the level of formation of skills to solve professionally oriented tasks of students of control and experimental groups, experimental observations were carried out, experimental data were processed, conclusions on the conducted study were formulated.

The following provisions shall be made for protection:

1. The method of teaching students - future teachers of mathematics scientific knowledge is based on the idea of projecting the activity of the teacher of mathematics with scientific knowledge on the process of studying the educational material of the school course of mathematics.

It includes in itself target (results of training), substantial (the systems of substantial components), and also procedural (a technique and tutorials) components.

The main means of teaching students - future teachers of mathematics is a system of tasks, the performance of which contributes to the formation of scientific knowledge, models the work of the teacher of mathematics in studying and proving mathematical statements.

2. The students thinking activity in the process of developing scientific material contributes to the formation of professional competence of the student - the future teacher of mathematics, which includes all the main characteristics of the students activity (cognitive, research, educational and professional).

3. The method of formation of readiness of future teachers of mathematics for organization of educational, cognitive and research activities of schoolchildren in the process of development of scientific (educational) material of elective disciplines in the university is effective, if meaningful components and method of teaching of scientific materials:

- includes invariant (content of educational material) and variable (developed system of tasks of educational, cognitive and research direction) parts;
- are focused on the activity method of education, which contributes to the development of the ability of students - future teachers to successfully organize educational, cognitive and research activities of students;

4. The method of using the designed system of content components is based on the definition of the main goals of the educational, cognitive and research work of future teachers of mathematics, which is to increase the level of professional knowledge and skills.

The scientific novelty of the study is that:

- the problems of designing and developing the content of elective courses in the system of higher pedagogical education are revealed;
- psychological and pedagogical factors of assimilation by students of the content of educational (scientific) material at studying of elective disciplines are defined, theoretical bases of designing of the content of educational materials are defined;
- the main requirements of designing the content of educational material of elective disciplines are defined, taking into account these requirements, a new scientific material of the elective course "Singularly offset common edge tasks with boundary surges for ordinary differential equations" has been created, at the same time the following new scientific results have been obtained in the theory of singularly disturbed edge problems:

a) An analytical representation of the solution of the singularly perturbed common edge problem has been built;

b) Asymptotic estimates of the solution of the perturbed common edge problem were obtained;

c) The character of growth of derivatives by small parameter is established;

d) Edge task classes are highlighted that have boundary hops in points $t = 0$ and $t = 1$;

e) An algorithm is developed with the help of which the asymptotic approximation of the solution and its derivatives is constructed up to an arbitrary order;

- development of content components of elective courses based on general requirements for content of elective course, principles and criteria of pedagogical didactics, which complement the existing system of content components of mathematical disciplines;

- the class of content components is identified, the methodology of design and use of content components is created, the possibility of realization of their basic function for formation of professional qualities of students - future teachers of mathematics is justified;

The theoretical significance of the study results is that:

– the methodology of development of content components is refined as the most important component of educational and methodological support of educational disciplines, which is a contribution to the theory of development of content of educational disciplines;

– the main components of the content components are formulated as the main means of teaching the scientific content of educational materials, which complements methods and means of building professional knowledge and skills;

– the requirements for the content of educational (scientific) materials are supplemented, which complements the theory of designing the content of educational disciplines;

– content components are classified, which contributes to the development of pedagogical didactics;

– the created scientific material of elective discipline "Singularly retributed common edge problems with boundary surges for ordinary differential equations" makes a certain contribution to the development of the theory of singularly perturbed edge problems.

Practical significance of the results of the study is that the received results can be applied by teachers, teachers at design of standard training programs of elective disciplines, when developing textbooks and manuals on mathematics in the system of the higher and secondary education;

Reliability of the received results research is provided: analysis of literature on the problem under study, use of a set of scientific methods of research, adequate to its logic, purpose, objectives and subject of research; a combination of experimental and theoretical research; the use of statistical methods and the mathematical processing of experimental data proving the success of the study.

Approbation of results of a research:

– the main provisions and results of the study were reported and discussed at scientific and methodological seminars of the department of mathematics and methods of teaching mathematics ZhGU name of I. Zhansugurova, the department of mathematics of the Women's State University (2018 and 2019 year);

– research findings were reported at scientific and practical conferences: International Conference “ III Borubaev’s Readings” (Bishkek, 2019);

V International Scientific and Practical Conference "Pedagogy of Modernity: Topical issues of psychological and pedagogical theory and practice "(Cheboksary, 2019);
III International scientific and practical conference "Science and education in the modern world: Challenges of the XXI century» (Nur-Sultan, 2019).

– the main results and provisions of the dissertation study are published in various scientific journals and collections (total of 8 works, of which 3 articles - in journals, included in the list of peer-reviewed scientific publications identified by the Committee for control in education and science Ministry of education and science of Kazakhstan, 1-article in the scientific international journal from the Scopus database, 1 article in the foreign scientific journal and 3 articles in the materials of international scientific atnd practical conferences)

Structure and content of dissertation work.

The work consists of an introduction, two sections, a list of used literature and annexes.

The *first section* presents the theoretical basis of design of content components of elective courses of mathematical profile in higher educational institutions.
At the same time, the psychological and pedagogical basis of design of the content of educational materials, the purpose and importance of elective courses in the process of formation of professional qualities of students are formulated.
General requirements for the content components of elective disciplines are formulated taking into account the general requirements for the content of the elective course and the principles and criteria of pedagogical didactics.
The content components of the elective course are designed based on the general requirements for the content components of the elective disciplines.

The second section explores the development of a methodology for teaching future mathematics teachers scientific materials through meaningful components of elective courses. At the same time, classification was carried out, importance of key content components of elective courses in higher mathematics was determined, design of scientific materials by content components of elective disciplines was determined. A methodology has been developed to train future mathematics teachers in scientific materials through meaningful components of elective courses.
The model of designing the content components of elective disciplines is developed. Results of experimental study are described.

The conclusion contains the main scientific results obtained.