ABSTRACT

for doctoral (PhD) thesis of **Torebek Yerlan Zhandarbekuly** on the theme "Theory and practice of teaching geometry at school using computer resources for educational purposes", presented for the degree of Doctor of Philosophy (PhD) on the specialty 6D010900 - "Mathematics"

Urgency of research subject. In the Message “New Development Opportunities in the Conditions of the Fourth Industrial Revolution” of 2018, the first President of the Republic of Kazakhstan N.A. Nazarbayev noted as one of the most important tasks the following: “It is necessary to strengthen the quality of teaching mathematical and natural sciences at all levels of education. This is an important condition for preparing young people for a new technological order. The content of the training should be harmoniously complemented by modern technical support. It is important to continue work on the development of digital educational resources, connecting to broadband Internet and equipping our schools with video equipment”

The strategic development plan of the country until 2020 indicates that e-learning is a priority for the radical modernization of education in the direction of informatization of the education system. Indeed, one of the urgent problems of modern theory and methodology of teaching mathematics is to identify the capabilities of computer resources in improving the quality of mathematical education of pupils and the development of methods for their use in teaching at a secondary school.

Geometry is one of the ancient sciences. Sources that have come down to us from the depths of centuries prove that people used geometric facts in 2000 to the o.y. Geometry as a science was formed in ancient Greece in the VII-II centuries o.y. Problems of teaching geometry, problems of methods of teaching geometry began from the time of Euclid, Archimedes, etc. and were in the field of vision of scientists and educators of various countries and peoples. A new stage in the general development of pedagogical science, especially geometry, posed the challenge for humanity to improve teaching and teaching methods. The problem of the methods of teaching geometry in a comprehensive school today is especially relevant in connection with the introduction of information technology.

The work of Torebek Yerlan Zhandarbekuly “Theory and practice of teaching geometry at school using computer resources for educational purposes” is devoted to the problem of identifying the possibilities of computer resources in improving the quality of mathematical education of schoolchildren and the development of methods for their use in teaching geometry.

Topic research level: In recent years, the problem of technical support in teaching mathematics has been particularly intensive in secondary schools and universities. Studies are conducted in various directions. They are devoted to publications by E.V. Ashkinuse, E.V. Baranova, N.V. Bolotova, V.A. Dalinger, Yu.A. Drobysheva, I.V. Drobysheva, E.V. Stepanova, M.N. Maryukova, I.V.Robert, A.S. Yakubova, I.M. Makarov and others. Analysis of research data

makes it possible to draw conclusions that the use of information technology in teaching mathematics has great potential. The works of B.S. Gershunsky, A.P.Ershov, M.P. Lapchik, L.I. Gritsenko, E.A. Mashbits, V.M. Monakhov, I.V.Robert and others.

At present, the following main scientific schools have been formed on the issue of informatization of education in the Republic of Kazakhstan, where comprehensive and specific studies are carried out: - the school of Professor E.Y.Bidaibekov on various aspects of the theory and methods of teaching the subject and preparing, from a methodological point of view, the application of information technologies; - development of the methodological system of fundamental and progressive teaching of students in programming, the creation of a theoretical foundation - Zh.K. Nurbekova; professional training of future teachers - S.S. Mausymbaev; mathematical modeling and computational experiment – L.B.Rakhymzhanova; Training using Internet technologies - S.N. Koneva and others; methodological preparation of pupils for the use of ICT - D.E.Sagymbaeva; the use of telecommunication technologies in teaching foreign languages - A.B.Nurova, methods of teaching English through electronic textbooks - U.T.Nurmanalieva; - The school of Professor B. B. Baimukhanov explores issues explores the implementation of computer technologies in the educational process, based on this, the questions of creating a methodology for using various software in the educational process: B. D. Sydykhov, R. S. Shuakbaeva, I.Zh. Esengabylov, G. A.Madyarova, the use of a computer in teaching mathematics in primary school - A.O. Baydybekova; - The school of Professor D. Rakhymbek explores the scientific and methodological foundations of preparing a future mathematics teacher to work on improving the logical and methodological knowledge of pupils and various points of view of the theory and methods of teaching mathematics: N.K. Madiyarov, M.O.Musabekov, R.I. Kenzhebekova, R.B. Bekmoldayeva, L.K.Zhaidakbaeva, R.I. Kadirbaeva, G.O. Zhetpisbaeva, E.Zh. Kosherov, M.A.Abdualiyeva and others examined the use of information technology in the preparation of future mathematics teachers, in educational process of a comprehensive school, the system of professional training and secondary education.

Recently, there has been widespread computer support for teaching mathematics courses. The use of computer resources can significantly increase the quantity and quality of students mastering educational material. Research on the creation and use of computer mathematical systems is also carried out with foreign colleagues (J.M. Laborde, F. Bellemein, J. King, D. Scher, etc.). The computer programs developed by them create the prerequisites for a computer geometric experiment.

Analyzing the experience of domestic and foreign colleagues in the use of computer resources, we can conclude that in the field of computerization of mathematical subjects, in particular in geometry, a well-known experience of theoretical and practical value has been accumulated, and the results have been obtained. Nevertheless, one can clearly notice the following reasons that impede the effective use of computer technology in teaching geometry. Lack of the

necessary amount of computer equipment at school, in the personal use of pupils and teachers. The lack of opportunities for teachers of mathematics to conduct lessons in their subject in computer classes. The absence in schools of mathematics teachers trained in the development of computer technology remains at a significantly high level. The lack of a methodological system for providing computer support for the geometric training of students in secondary schools. Lack of computerized training programs in secondary schools that meet the relevant requirements of geometric training. Also, there are some contradictions: the increasing role of computer resources among scientific mathematical research and the situation in the development of society, their influence on various levels of education and the lack of an alternative type of this role in the learning process of students in secondary schools; - the objective need to provide computer support for the school course in geometry and software for computer resources for educational purposes at present; the lack of training tools on the use of software and teaching tools on geometry and the use of information technologies for the geometry course, among the process of creating, along with the methodology of proposals and workshops, a computer-directed teaching methodology for specific topics and sections of the geometry course and methodological foundations for the training of mathematics teachers based on information technologies; potentially high possibilities of informatization as an increase in the effectiveness of geometry training and contradictions among the experience of learning geometry in secondary schools that do not fully use these opportunities. These contradictions determine the relevance of the study and make it possible to draw the following conclusion: the definition of the theory and practice of teaching geometry using computer resources in secondary schools. In this regard, this served as the basis for choosing the topic of our research work: " Theory and practice of teaching geometry at school using computer resources for educational purposes"

Objective: To determine the theoretical foundations and methods of teaching school geometry using computer resources for educational purposes.

Object of research - the process of learning geometry in secondary schools using computer resources for educational purposes.

Subject of research: The theory of teaching school geometry using computer resources for educational purposes.

Scientific hypothesis of the research: when teaching school geometry using computer education resources, favorable conditions will be created to increase the level of mastery of the subject of geometry, the quality of knowledge and skills of pupils, since it meets the requirements of improving the educational process.

Research problem: improving the theory and practice of teaching school geometry using computer resources for educational purposes.

Based on the objectives of the study and forecasts, the following **research tasks** were established based on the analysis of scientific, methodical literature and the experience of teaching geometry in secondary school:

- Analysis of the current situation of teaching geometry in secondary schools, the theoretical foundations of teaching geometry using computer resources for educational purposes;

- Definition of cognitive and didactic possibilities of using computer resources in the process of teaching school geometry;

- Definition of the content-structural features of the use of computer resources for educational purposes in teaching pupils of school geometry;

- Proposal of the methodology for using computer resources for educational purposes in the process of teaching school geometry;

- Show evidence of the effectiveness of the methodology of using educational computer resources for educational purposes in teaching school geometry based on experiment.

The leading idea of research: given the place occupied by the methodical system of using educational computer resources in teaching school geometry, the integrated use of the most convenient established criteria for the effectiveness of using software products in the process of teaching geometry provides the applied nature of the subject “Geometry” and affects the complete formation of geometric knowledge and skills pupils.

The methodological and theoretical foundations of the research work: cognitive theory, systemicity, action, differentiation in teaching, humanization in education, theories related to mathematical education and methodology, as well as the training of future mathematics teachers.

Sources of research: the Constitution of the Republic of Kazakhstan, the works of philosophers, psychologists, teachers, methodologists regarding the research problem, official documents in the field of education, general educational standards, curricula and programs, the Law of the Republic of Kazakhstan “On Education”, the State Program for the Development of Education in the Republic of Kazakhstan for 2011 -2020 years.

Research methods: research and analysis of psychological, pedagogical, scientific and methodological literature, programs for teaching mathematics in high school, textbooks and teaching aids; educational process control; conducting interviews with teachers and students, conducting a survey among them; checking the level of mathematical preparation of pupils by conducting diagnostic tests; study of pedagogical practice; theoretical generalization of research results, modeling of individual lessons; software script development; pedagogical experiment and mathematical methods for their processing.

The purpose of the experiment is to analyze the psychological and pedagogical characteristics of students, the reasons for the low level of knowledge acquisition by students and the search for opportunities to improve the learning process of a geometry course using computer resources in a comprehensive school. As a result, a conclusion was drawn on the conformity of the use of computer resources to the goals set and a hypothesis of the study was formulated. Also, work was done to develop a methodology for the use of computer resources in teaching school geometry. Its creation was adopted in 2017-2019. according to the search results, then according to the results of training experiments. To develop programs

of the methodology for using computer resources in teaching school geometry, programming languages of the highest level were used.

The main periods of research:

I period (2016-2017) - an analysis of domestic and foreign literature and publications on the topic of the research, the main ideas of the original sources are explained and the periods of the pedagogical experiment are determined. The analysis of teaching school geometry using computer resources is carried out, the state of training of future mathematics teachers in higher educational institutions is determined. The theoretical foundations of teaching school geometry using computer resources are determined, the goals and objectives of the study, the object and subject, the scientific hypothesis of the study are clarified, an experiment is conducted.

II period (2017-2018) - didactic possibilities of using computer resources in the process of teaching school geometry for education and basic principles, content, methods and types of their application are determined. The content-structural features of the use of computer resources for the purpose of teaching school geometry are formulated. In connection with determining the effectiveness of training, formative experimental work was carried out, and intermediate results were analyzed.

III period (2018-2019) - a methodical system for teaching school geometry using computer resources is defined. The conclusion of the methodology of using computer resources for the purpose of teaching geometry is made. The results of a practical experimental verification of the effectiveness of the methodology prepared during the study are summarized; a qualitative and quantitative analysis of the results is carried out. Conclusions on research work have been prepared, a list of used literature has been systematized, the dissertation has been framed in accordance with the requirements.

Study base. specialized school - boarding school named after N.Ondasynov in the city of Turkestan, secondary school named after S. Rakhimov, secondary school № 35 "Bolashak".

Scientific discoveries of research:

- The theoretical foundations of teaching school geometry using computer resources have been clarified;
- The content-structural features, cognitive-didactic possibilities of using computer resources in the process of teaching school geometry were determined;
- A methodology is proposed for the use of educational computer resources in the process of teaching school geometry;
- The effectiveness of teaching school geometry using computer resources is determined by experimental work.

The theoretical significance of the research: in the conditions of informatization of the society, an analysis of geometric knowledge and teachings of pupils in secondary schools was carried out, the reasons that impede the effective use of computer resources in the process of teaching pupils of school geometry were established; for educational purposes, cognitive-didactic

possibilities of using computer resources in the process of teaching school geometry are proposed.

The practical significance of the research is the creation of teaching methods for the use of computer resources aimed at increasing the knowledge of students of secondary schools in geometry. The developed methodology in the process of teaching school geometry using computer resources can be applied during the training of geometry in secondary schools in the system of training, retraining and advanced training of teachers.

Basic concepts, submitted for the defense of dissertation:

1 Learning school geometry using computer resources has a significant impact on the quality and level of assimilation of educational material by pupils. Theoretical foundations of teaching school geometry as an activation of computer resources, taking into account cognitive and didactic opportunities.

2 Basic principles, content and methods of using computer resources based on different opinions on the development of methods for teaching school geometry. The technique of using computer resources in the process of teaching school geometry.

3 Comprehensive support for the process of teaching school geometry using computer resources with teaching materials (curricula, textbooks, teaching aids, electronic textbooks, computer training programs), didactic fundamentals of increasing the knowledge and skills of pupils in the field of using computer resources for education.

Argumentativeness and validity of the results of the research a comprehensive analysis of the educational literature and teaching aids on the topic of the dissertation, based on them during the study; the main results and conclusions of the dissertation correspond to the principles of modern psychology and didactics, computerization of education and, the logical application of methods that are consistent with the goals and objectives of the study, its objects, theoretical conclusions, subject, experimental results with theoretical, methodological evidence and evidence from a practical point of view; it is ensured by the effectiveness of the theoretical conclusion, sufficient coverage of the number of participating teachers in the experiment, and by processing the results of the experiment by mathematical statistical methods.

Evaluation of the research. The main results of dissertation were stated at the next conferences:

1) VIII International scientific conference "Mathematics. Education. Culture", devoted to the 240th anniversary of the mathematician K.F. Gauss (Togliyatti 2017)
2) Auezov readings-17: at the International Scientific and Practical Conference on the topic: “New impulses of science and spirituality in the global space” (Shymkent, 2019).
3) «III International conference «Industrial technologies and engineering» «ICITE-2016» (Shymkent 2016)
4) News of the Khoja Akhmet Yassawi kazakh-turkish international university, Mathematics, physics, computer science series. Special issue

on the materials of the conference of Mathematicians of Kazakhstan «Actual problems of mathematics» (volume II)

5) Conference devoted to 80th anniversary of the Doctor of Education, professor Kaiyrzhan Gabdollauly Kozhabayev «Modern mathematical education: practice, problems, future» on June 8-9, 2018, (Kokshetau, 2018)
6) International scientific magazine «Nauka I Zhizn Kazakhstana», (series Pedagogics No.2 (44) 2017, Astana),
7) in «Bulletin» journal of Abay Kazakh National Pedagogical University, (series Physical and Mathematical Sciences, No. 3,4 (59,60) 2017)
8) journal «Vestnik» of the Academy of pedagogical sciences of Kazakhstan" (No. 6, 2017, Almaty),
9) «Man in India» journal (ISSN: 0025-1569. Vol. 97, July (2017))
10) «European Journal of Contemporary Education» journal. E-ISSN 2305-6746 2018, 7(3).
11) “Cylinder Volume” (Computer Program). Certificate of state registration of copyright No. 3488. 05/22/2019
12) Teaching aid “Use of computer resources of education in teaching geometry”, (Shymkent, 2019)
13) "Area of the triangle" (Computer Program). Certificate of state registration of copyright No. 5513. 09/27. 2019

Information about publications. According to the results of research of scientific work, a total of 20 scientific papers were published. Of these, in publications approved by order of the Committee for Control in Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan - 7 articles, in foreign publications included in the Scopus and Web of Science database - 2 articles, at international scientific and practical conferences - 4 articles, at foreign international international scientific and practical conferences - 4 articles, 2 electronic textbooks with registration of copyright certificates and 1 teaching aid.

Structure and scope of the dissertation. Dissertation consists of 154 sheets in the text printed on the computer, it includes 8 tables, 74 drawings. The dissertation consists of Introduction, 2 Sections, Conclusion, List of refference and Annexes.