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STRUCTURAL AND CONTENT MODEL FOR DEVELOPING CARTOGRAPHIC COMPETENCY IN FUTURE GEOGRAPHY TEACHERS

Annotation. This article explores the model of the formation of cartographic competence of future geography teachers. Cartographic competence is an integral part of the professional competence of future geography teachers. Any study begins with a geographical map and ends with a map. Cartographic knowledge and skills play a special role. Cartographic literacy is an integral part of geographical education. In the process of geographical education, the cartographic competence of the future geography teacher is of particular importance, as it requires a set of subject competencies in working with geographical information and teaching. It is necessary to constantly form and develop cartographic competence in the interpretation of geographical phenomena and processes. He belongs to the hard skills of a geography teacher. Its formation through spatial thinking, analysis and understanding of spatial data, work with cartographic tools constitutes an urgent problem. This will allow in the future to improve the quality of geographical education. The basis of professional subject competencies of future geography teachers is a set of cartographic knowledge, skills and abilities. It is necessary to constantly repeat and improve actions in working with a geographical map. A review of the scientific works of Russian, Foreign and Kazakh researchers is carried out. In the development of the model, the methodology of scientists engaged in research work in the methodological direction was guided.

Keywords: geography teacher, pedagogical activity, cartographic competence, cartographic literacy, model, cartographic skill, geographical map, methodology

Introduction. Significant changes are taking place within higher education in the Republic of Kazakhstan. Preparing competitive professionals is a key factor in driving sustainable economic growth. Today's demand is to train highly competent geography teachers who are adaptable to rapidly changing conditions, capable of applying new methods and techniques in teaching, and proficient in providing quality education.

Every action of a geography teacher in the classroom is closely connected with the use of geographical maps, which represent the primary language of geography. Teachers explain geographical objects, phenomena, and processes to students with the aid of maps. The use of geographic maps has expanded significantly, and numerous mapping programs are widely used. The variety and importance of web-cartographic resources have increased, along with the emergence of electronic and virtual maps. Activities related to map creation, storage, analysis, synthesis, and forecasting are becoming more complex. Both cartography and geoinformatics have achieved significant advancements, and the demands on geography teachers have grown. Thus, it is essential to develop a methodology for fostering cartographic competence in future geography teachers.

For effective work with physical and thematic maps, it is necessary to enhance the cartographic skills of future geography teachers, including the ability to interpret map symbols, extract additional information, distinguish similarities and differences in geographical objects, and comprehend geographical names, all of which contribute to their cartographic literacy.

The activities of geography teachers during lessons are closely related to the use of geographical maps. Any research should begin and end with a map. Through working with maps, geography teachers develop their cartographic knowledge, skills, and competencies. These activities pave the way for the development of their professional subject competencies. Research work has been conducted both abroad and domestically on the cartographic activities of teachers.

A model is applied within the pedagogical education process to develop cartographic competency in future geography teachers. This model promotes the systematic use of scientific approaches and methods, ensuring logical consistency between content and structure. Several scientific research studies have developed models for building knowledge, skills, abilities, and competencies among educators.

Literature review

In the research work of Ph.D. E.A. Sankova, a model for developing students' cartographic competency in higher education institutions was created using professional-oriented teaching technology, exemplified through training geographers, soil scientists, and environmentalists. The researcher defined "cartographic competency" as the readiness and ability to utilize knowledge, skills, and abilities acquired in cartographic disciplines to perform academic-professional activities, including creating, analyzing, and using various cartographic products, conducting measurements, and creating topographic surveys of local areas. The researcher divided cartographic competency formation into low, medium, and high levels [1]. In this model, the content of cartographic disciplines is carefully selected, emphasizing both scientific and practical importance. The students' learning opportunities and material resources are considered. Teaching methods, techniques, and tools are chosen and methodologically substantiated. Monitoring of the development of cartographic competency is conducted through evaluation and assessment, with results showing that professional-oriented teaching technology is effective for this purpose.

In T.S. Komissarova's research, while no specific definition of cartographic competency is provided, the idea of competency is present, with three levels of cartographic competency outlined. At the first level, future geography teachers demonstrate strong map knowledge and work effectively with graphic information. The second level includes performing research, creative tasks, and understanding worldview issues. At the third level of professional cartographic competency, teachers enhance their cartographic literacy through map-based teaching methods and effectively use methods in working with students [2]. The research concludes that cartographic competency develops gradually.

In developing the structural-content model for developing cartographic competency in future geography teachers within pedagogical universities, the works of national scholars were analyzed. The PhD research of F.K. Mizambaeva, titled "Formation of Professional Competence of Future Geography Teachers: Essence, Problems, and Prospects," examines the content and structure of a six-credit elective course, "Digital Mapping Technologies." The researcher emphasizes GIS programs commonly used in digital mapping, employing methods for constructing geographic databases and using interactive

electronic maps, structured into four modules with learning outcomes designed in accordance with Bloom's Taxonomy, and includes evaluation criteria [3].

In Turkiye, Professor Bülent Aksoy from Gazi University, Ankara, highlights the increasing importance of geographical maps as an information source and has conducted studies aimed at developing students' skills in reading, composing, and creating maps. The researcher provides a methodological analysis of the ways to cultivate students' cartographic literacy [4].

The creation of models in pedagogical science systems is guided by multiple scientific approaches. A. Diesterweg, regarded as the founder of the activity-based approach, posited that teaching and educational processes can only occur through a person's intrinsic actions [5]. According to this approach, teachers' competencies are continuously formed through actions associated with cartographic tasks.

Researcher A.V. Khutorsky identifies the core of the activity-based approach as the learners' actions, where they undergo personal development and acquire cultural-historical achievements. He differentiates three approaches to mastering material: reproductive, self-directed knowledge acquisition, and production-oriented learning. Reflective educational activity plays a vital role throughout all stages of learning, aiming to facilitate students' independent analysis, adjustment of goals, and assessment of outcomes [6]. In the activity-based approach, teachers are expected not to merely possess knowledge in a specific subject area but to be capable of independent action, which encourages the successful formation of general academic skills.

In his work Activity, Consciousness, Personality, A.N. Leontiev discusses personality as a unique reality that emerges and develops through interactions within life activities. He describes activity types such as object-based, individual, and instructional, which foster a quest for knowledge, reflection, intellectual engagement, and the design of paths for future improvement. He thus views personality as an interconnection among various activity levels [7]. Repeatedly performing specific activity types in daily life can cultivate skills.

A competency-based approach has been incorporated into higher education systems to enhance the competitiveness of specialists and improve interaction with the labor market. A qualified specialist is distinguished from a competent specialist by not only possessing knowledge, skills, and abilities but also being able to apply them in practice [8]. Geography teachers can combine their knowledge, expertise, and experience in performing map-related tasks.

E.Ya. Kogan sees the competency-based approach as a new direction that necessitates a reassessment of the teacher's perspective and teaching practices, aiming for a comprehensive transformation from conceptual change to methodological foundations [9]. The competency-based approach creates an environment conducive to each student's developmental needs. The teacher's primary responsibility is to motivate students and foster independent work.

O.E. Lebedeva describes the competency-based approach as a set of principles that define educational goals, select content, organize the process, and evaluate outcomes. These principles include the importance of learners' ability to independently solve problems across various fields, drawing from diverse experience, and the student's own knowledge. Educational content utilizes social experience, adapted didactically to address cognitive, ethical, political, and other issues. The educational process aims to foster cognitive, communicative, organizational, ethical, and other traits required for problem-solving. The competency-based approach emphasizes

applied and practical orientations within the educational process, and results assessment is based on learners' achievements over time [10]. Teachers' cartographic competency should be grounded in pedagogical principles, with the competency-based approach facilitating active, rather than passive, knowledge acquisition.

To implement the competency-based approach, it is necessary to develop a model of general and professional competencies. In his research, L.D. Davydov presents a model of professional competency development comprising content, activity, and outcome blocks. The content block encompasses the structure of competencies and qualities, curriculum structuring, defining requirements for skilled professionals, knowledge, skills, and monitoring the development of students' competencies. The activity block focuses on external and internal factors to achieve goals and employs technological methods in training based on pedagogical conditions. The diagnostic block monitors students' competency development dynamics by setting criteria for all types of competencies and assessing competency levels [11]. This approach strengthens the practical orientation of the educational process. Geography teachers should not only accumulate theoretical knowledge but also apply it as a practical tool for interpreting various phenomena and processes, thereby enhancing their cartographic competency.

Research Methods - Analysis, synthesis, statistical analysis, cartographic and comparative analysis

Results and discussion

After studying the works of domestic, Russian, and foreign researchers, a schematic structural-content model for developing cartographic competency in future geography teachers was developed (figure-1). The model includes several structural blocks and content components. The goal component defines the development of cartographic competency in future geography teachers. Achieving this goal requires defining necessary educational activities and fostering subject competencies.

The normative component is based on the Professional Standards for Educators [12] and the B014-Geography Teacher Training Educational Program. This component outlines the requirements for teachers' professional competencies and the regulatory acts guiding pedagogical activities, with an emphasis on continuous professional development.

The educational program is designed based on the state standard for higher education. The program is approved by the University's Academic Council, and graduates are awarded the academic degree of "Bachelor of Education." This model is based on the Geography Teacher Training Program of KazNPU named after Abai, which was approved and implemented in 2023.

The model is guided by systematic, activity-based, personality-oriented, practice-oriented, and competency-based approaches. The systematic approach ensures the consistent implementation of goals, the normative component, content component, activity, and outcome components. The activity-based approach illustrates actions aimed at developing cartographic competencies. Personality and practice-oriented approaches emphasize developing geography teachers as individuals and substantiate their knowledge practically. The competency-based approach contributes to teachers' professional growth.

Content Component includes cartographic knowledge, skills, and abilities embedded within the foundational and specialized subjects of the educational program, covering topics related to geographic maps in each discipline, fostering cartographic literacy, understanding specific features of cartographic representation methods, and working with geographic databases.

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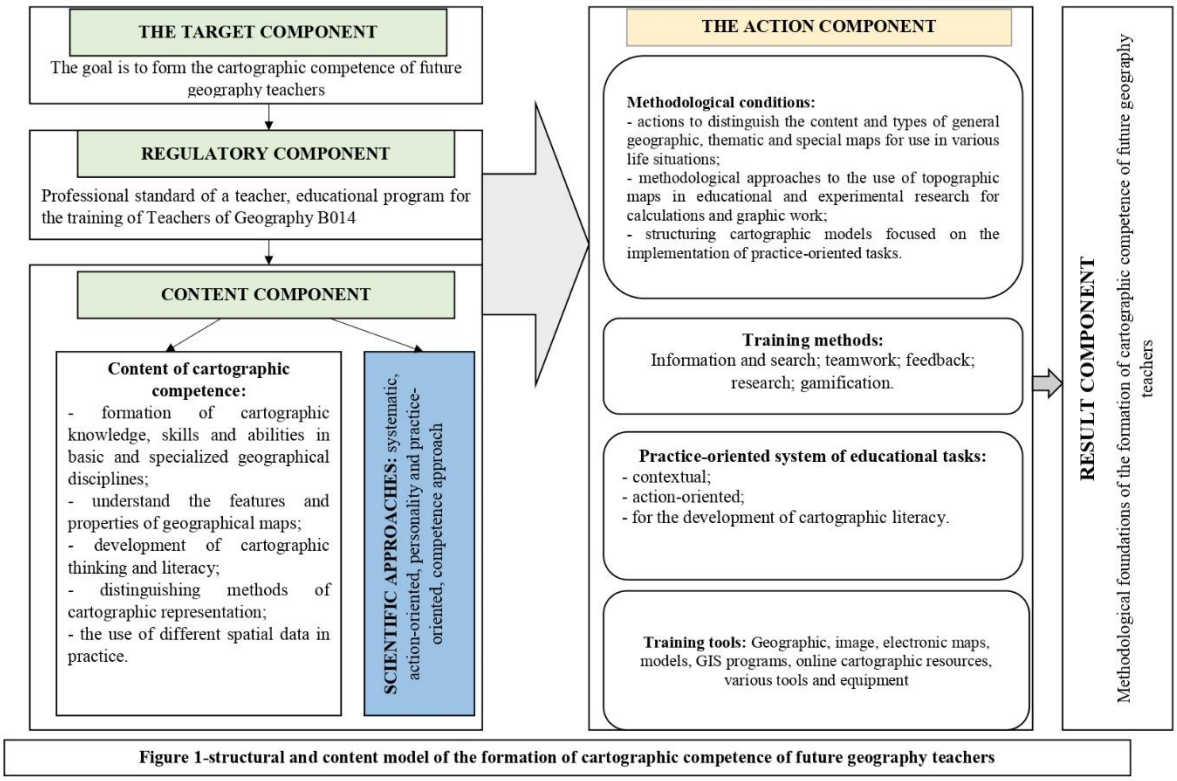


Figure 1-structural and content model of the formation of cartographic competence of future geography teachers

In the Activity Component, it emphasizes linking acquired knowledge to daily life, methodological approaches to performing various cartometric tasks, and providing a system of practice-oriented assignments. The system of practice-oriented tasks is context-based, action-oriented, such as marking geographic objects on an outline map and developing tasks for cartographic literacy. The main teaching tools include geographic maps, atlases, outline maps, online cartographic resources, models, and various cartographic tools and equipment. Regular work with these tools leads to the development of cartographic skills, which, in turn, form the prerequisites for cartographic competence.

Cartographic literacy is the ability to work with maps and plans, acquire topographic knowledge, and apply it practically. The primary method for developing cartographic literacy is focused on working with geographical data. In this regard, one of the subjects taught at higher education institutions, "Fundamentals of Cartography and Topography," is aimed at cultivating cartographic literacy in future geography teachers.

The system of geography assignments aimed at developing cartographic competency is structured according to B. Bloom's taxonomy levels. In line with Bloom's taxonomy, tasks consist of knowledge, comprehension, application, analysis, synthesis, and evaluation. The assignment system was developed using the subject "Fundamentals of Cartography and

Topography," a core geographical subject in higher education institutions.

Assignment 1. Provide a definition of a geographic map. List the characteristics of a geographic map.

Bloom's Taxonomy Level: Knowledge

Methodological Explanation. During this task, students understand that maps are a primary teaching tool in geography and define it scientifically. A geographic map is an image of the Earth's surface or any part of it, reduced to a specific scale. Students can name the characteristics inherent to geographic maps. First, a geographic map includes all phenomena and objects in the geographic shell (lithosphere, hydrosphere, biosphere, atmosphere). Second, a map allows for the determination of the location and area of any object.

Assignment 2. Classification of geographic maps

Bloom's Taxonomy Level: Comprehension

Methodological Explanation. In this task, students explain the meaning of classification. Classification involves categorizing any phenomenon or objects according to general characteristics. The primary criteria for classifying maps include content, area covered, function, scale, method of use, year of publication, and others. Based on content, maps are divided into general, thematic, and special categories. Based on area covered, they are classified as global, continental, oceanic, parts of the world, parts of continents, individual countries, parts of countries, regional, and local maps.

Assignment 3. Calculate the geographic coordinates of the city of New Delhi using a geographic map

Bloom's Taxonomy Level: Application

Methodological Explanation. In this task, students learn to calculate the latitude and longitude of a city using a map. Geographic coordinates are angular measurements that determine the position of any point on Earth. They include latitude and longitude and are widely used in maritime and air navigation, as well as in all fields of geographical science.

Steps:

- Locate New Delhi on the map;
- Determine its latitude and longitude (north or south latitude, east or west longitude) using the equator and prime meridian lines on the map;
- Find the degree intervals of parallels and meridians on the map;
- Measure the distance between parallels and meridians with a ruler and create a proportion;
- Calculate the latitude and longitude of the city.

Assignment 4. Analyze the characteristics of a geographic globe and compare it to a map

Bloom's Taxonomy Level: Analysis and Synthesis

Methodological Explanation. In this task, students define the globe, view the equator, parallels, meridians, northern and southern tropics, polar circles, the prime meridian, and geographical poles on it, and identify the objects crossing these lines. Key characteristics of a geographic globe:

- The globe divides the Earth's surface into six continents and four oceans, with their locations clearly shown;
- The equator divides the globe into northern and southern hemispheres;
- The prime meridian divides the globe into western and eastern hemispheres;
- The lengths and positions of meridian and parallel lines on the globe correspond to the Earth's surface;
- Scale is maintained throughout the globe.
- Comparison with maps:
- Maps are more frequently used than globes;
- Globes have less distortion compared to maps;

- A globe is an exact model of the Earth;
- Maps are more convenient to use than globes;
- Only two types of globes exist: general and political;
- Many types of maps exist.

Assignment 5. Evaluate the role of the QGIS program in creating geographic maps

Bloom's Taxonomy Level: Evaluation

Methodological Explanation. In this task, students review map-making methods and describe the unique features of the QGIS program used in map creation. They explain that QGIS allows for raster and vector data editing and exporting in various formats. Students analyze the functions of the program's tools and demonstrate how to use GPS equipment to import and export data. By examining spatial data, students evaluate QGIS's role in creating geographic maps.

The Result Component will develop a methodology for forming cartographic competence. The proposed model will contribute to the development of cartographic competence in future geography teachers.

Conclusion. In accordance with the research topic, an analysis of scientific papers was carried out. The methodology developed by Russian methodologists was considered comprehensively. A review of the works of foreign scientists was made. A structural and content model for the formation of cartographic competence of future geography teachers was proposed. The components of the model were characterized.

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