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FORMATION OF CARTOGRAPHIC CONCEPTS AMONG ACADEMIC LYCEUM STUDENTS

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Abstract
In the process of geography education, the acquisition of cartographic knowledge by academic lyceum students is of particular importance. By its nature, this type of knowledge creates broad opportunities for students not only in their academic activities but also in everyday life, such as constructing buildings, ensuring access to water sources (wells), cultivating land, developing professional farming or household plots, organizing production and trade, selecting geographically favorable areas, and establishing cooperation with business partners. Therefore, when organizing geography education in academic lyceums, serious attention must be paid to ensuring the thorough mastery of cartographic knowledge by students. This article discusses the key aspects that should be considered in order to achieve a solid acquisition of cartographic knowledge among academic lyceum students.

Keywords: Academic lyceum, student, geography education, cartography, cartographic knowledge, development of cartographic knowledge.

Introduction

Geographical knowledge occupies an important place in the system of scientific and practical knowledge acquired by academic lyceum students. Through mastering such knowledge, students succeed in assimilating essential information relevant to everyday life. Information related to the natural and social environment, geographical characteristics of specific regions, economic development of society, and the influence of geographical specificity on people's lifestyles, labor activities, and the formation of social relations not only enriches students' geographical knowledge but also develops their scientific thinking and broadens their worldview. For this reason, geography education in academic lyceums is assigned the task of "forming students' cartographic knowledge and skills" [7, p. 121].

In the context of global informatization, unprecedented changes in geopolitical, economic, socio-cultural, climatic, demographic, and environmental processes have led individuals, including those studying geography, to face the challenge of purposefully and effectively mastering large volumes of information.

Literature Review

In geography education, working with maps constitutes an essential component of the practical knowledge to be mastered in the relevant field. Indeed, the "main elements of geographical knowledge require systematic work with specialized maps across all sections of the general

course and continue to develop through further study of the foundations of the discipline" [7, p. 121].

The development of cartographic knowledge among academic lyceum students is an integral part of comprehensive geographical education and represents a distinctive educational process carried out in several stages. In Uzbekistan, until 2021, students initially became acquainted with the most basic concepts related to geographical maps during the early stages of the continuous education system through the subjects The World Around Us (Grades 1–2) and Natural Science (Grades 3–4). Beginning with the 2022–2023 academic year, the subject Natural Sciences was introduced, designed for Grades 1–6 in general secondary schools and integrating introductory concepts from several disciplines, including chemistry, geography, biology, and physics [2].

Previously, the Science subject had been taught only in private schools and Presidential schools within the education system. From that point onward, in all general secondary schools, teaching has been based on the Natural Sciences textbook, which integrates introductory concepts from multiple subjects—The World Around Us, Natural Science, Geography, Biology, and Physics—thereby fostering interdisciplinary integration in education [1].

"The new subject is aimed at forming students' initial skills in geography, biology, physics, chemistry, and astronomy" [4]. Naturally, the introduction of this new subject has also resulted in changes to the curriculum.

Research Methodology

In the article, knowledge related to the environment, social reality, flora and fauna, and production is presented in simple and accessible ways, taking into account the age and psychological characteristics of students.

Analysis and Results

According to a statement made in January 2022 by the Ministry of Public Education of the Republic of Uzbekistan (currently the Ministry of Preschool and School Education), "in order for students to acquire sufficient skills and competencies in primary grades, and based on international experience, it became necessary to increase the number of lesson hours allocated to the new subject in primary education. In this regard, instead of the subjects Geography, Biology, and Physics taught in Grade 6 for 2 hours per week each (a total of 6 hours), a single subject, Natural Sciences, was introduced with 3 hours per week.

The remaining 3 weekly hours were redistributed within the framework of Natural Sciences to Grades 2, 3, and 4. That is, these grades were allocated an additional 1 hour per week each, totaling 3 hours" [4]. "Along with other subjects, topics related to geography were integrated into the Natural Sciences curriculum, and overall, the number of geography-related topics in the program increased from 291 to 387 topics, that is, by 96 topics" [5].

According to the order of the Minister of Preschool and School Education of the Republic of Uzbekistan "On Approval of the Core Curriculum for General Secondary Schools for the 2023–2024 Academic Year," the distribution of instructional hours for the subject of Geography (integrated with Economics) was established for Grades 9–11 of general secondary schools, as

well as, alternatively, for Years 1–3 of academic lyceums. Accordingly, Geography is taught in an integrative manner with Economics for 2 hours per week in Grades 9–10 and for 1 hour per week in Grade 11 [8].

While this situation has positive aspects, it also gives rise to certain challenges in organizing geography education in academic lyceums as one of the general secondary education institutions. The main issue lies in the fact that in primary grades, based on students' age and psychological characteristics, knowledge related to the environment, social reality, flora and fauna, and production within the Natural Sciences subject—along with other disciplines—is presented in a simplified and elementary manner.

However, acquiring cartographic knowledge requires familiarity with relatively complex information. Consequently, the methods used to present educational content in primary grades do not inherently allow for the in-depth study of working with geographical maps, delineating territories using topographic maps, or understanding detailed geographical characteristics of regions. Such characteristics include geographical latitude and longitude, climate, population size and growth or decline rates, economic and socio-cultural development, natural resources, key sectors of the national economy, flora and fauna, as well as economic and social challenges. These aspects are essential for understanding "the interconnections and patterns between various fields of science and life" [6], yet they cannot be adequately addressed within the simplified instructional framework.

The study of the current state of cartographic knowledge dissemination in general secondary education institutions (schools and academic lyceums) indicates the presence of a number of unresolved problems. During the research process, attention was also paid to identifying solutions to these issues. The following table presents the key challenges facing geography education in general secondary education institutions and their corresponding solutions (Table 1).

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Table 1. Problems and Solutions in the Promotion of Cartographic Knowledge (Example of General Secondary Schools and Academic Lyceums)

No	Problems	Solutions
1.	Insufficient allocation of instructional time	Enriching students' cartographic knowledge through subject-based clubs or extracurricular circles such as "Working with Maps"
2.	Low level of students' cartographic competence	Developing students' cartographic competencies through small-scale research activities and project-based learning
3.	The need for a large amount of time to work with outline (contour) maps	Developing an interactive map constructor adapted to the conditions of Uzbekistan (based on the *+1C: Interactive Map Constructor*, Russia, 2014) and using it in geography education, as well as employing alternative interactive map tools comparable to this constructor
4.	The rapid updating of geography-related information and the existence of discrepancies between current data and available educational materials and geographical maps	Establishing "Geographical and Cartographic Rapid Support" by ensuring the prompt updating of geographical data by the relevant department of the Education Center under the Ministry of Preschool and School Education, as well as achieving the systematic renewal of educational maps (at least once every two years) through the formation of collaboration between this department and the State Committee of the Republic for Land Resources, Geodesy, Cartography, and State Cadastre
		Developing a "Dynamically Changing Maps" model that records geographical changes occurring in educational maps within short timeframes, through the formation of a team of qualified computer programmers under the Education Center, established in cooperation between the Ministry of Preschool and School Education and the Ministry of Innovative Technologies
5.	Lack of high-level technological competence among subject teachers	1. Developing methodological guidelines by the Republican Education Center aimed at effectively enhancing technological competence among geography teachers. 2. Enriching in-service professional development programs with practical knowledge that develops teachers' technological competence in advanced educational technologies, particularly those that support the effective teaching of cartographic fundamentals.

In academic lyceums, as in other institutions operating across all stages of continuous education, geography education—which provides knowledge about the structure and fundamental principles of natural and socio-economic complexes—relies on various types of maps included in textbooks, such as outline maps, wall maps, and atlases. Regardless of the type of map, the most important element in working with maps is the ability to "read the map". This is considered a crucial didactic requirement for effectively developing students' map-reading competence in geography lessons.

According to relevant sources, students' competence in reading geographical maps is manifested through a variety of skills: reading map grids, scales, and conventional signs;

writing dictations based on topographic maps; interpreting relief and composing its description; studying geological and technological structures and drawing conclusions; investigating mineral resources; studying climate and composing its description; analyzing geographical conditions; studying soil and vegetation cover; investigating fauna; studying natural complexes; composing a general natural-geographical description of a location; studying natural resources; reading population maps; studying the fuel and energy sector; reading industrial maps; reading agricultural maps; reading transportation maps; reading international economic relations maps; and interpreting complex economic-geographical maps.

The process of providing cartographic knowledge in academic lyceums has distinctive characteristics. At this stage of continuous education, the teaching of cartographic fundamentals highlights several key aspects. First, based on students' age and psychological characteristics, general skills for assimilating knowledge are formed, allowing the use of complex maps. Second, students acquire general cartographic concepts—such as map, plan, geographic map, aerial photograph, satellite image, scale, projection, and qualitative signs—along with stable competences in map reading. Third, it is necessary to create didactic conditions to ensure students fully master the classification of geography maps.

Additionally, strategies should be developed to enhance students' abilities to distinguish and describe maps according to territorial coverage, content, purpose, and scale. There is also an educational need to create innovative practical-methodical projects using modern teaching technologies and actively implement them in teaching practice.

By its nature, providing cartographic knowledge in geography education at academic lyceums is a distinctive teaching process organized in several stages. Considering the content of geography education, its specific characteristics, students' mastery of relevant competencies, and the objectives of the teaching process, it is ensured that the dissemination of cartographic knowledge in academic lyceums proceeds systematically through multiple stages.

Table 2 The Main Stages of Providing Cartographic Knowledge in Academic Lyceums

Stage	Content of Activities	Methods and Expected Outcomes
Stage 1	Diagnosing students' level of cartographic knowledge	Using pedagogical observation, mini-research, surveys, interviews, tests, and reviewing pedagogical documents (grade lists, student and group portfolios) to identify the current level of cartographic competence (CC).
Stage 2	Reinforcing students' cartographic knowledge	Using explanation, clarification, demonstration (by teacher, student, or group), and exercises (academic and creative tasks) to enrich existing knowledge with new concepts.
Stage 3	Developing students' cartographic knowledge	Using research methods such as analysis, synthesis, comparative analysis, and project work to help students acquire new knowledge and develop creative thinking skills.

Conclusion and Recommendations

Thus, in the modern context, the economic, socio-cultural, demographic, climatic, ecological, and other changes occurring at both global and national (Uzbekistan) levels create a pressing need to continuously and systematically update the foundations of geographic, particularly cartographic, knowledge. At the same time, challenges arise in effectively promoting cartographic knowledge, and addressing these challenges requires the identification and implementation of effective solutions.

The development of cartographic knowledge in students of academic lyceums is a complex process carried out in several stages. Successfully achieving the specific educational objectives at each stage ensures high efficiency in teaching geography within academic lyceums.

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