

TETIANA NAZARENKO  
ORCID iD: <https://orcid.org/0000-0001-7354-5245>  
[geohim@ukr.net](mailto:geohim@ukr.net)

Institute of Pedagogy of the National Academy  
of Pedagogical Sciences of Ukraine  
Ukraine, Kyiv

Nazarenko, T. (2019). Cartographic literacy  
as a condition of communication and  
security. *Intercultural Communication*,  
ISSN 2451-0998, vol. 1(6)2019, pp. 117–137.  
DOI: 10.13166/inco/103629

## Cartographic Literacy as a Condition of Communication and Security

---

### ABSTRACT

Modern Ukrainian school faces a serious task: to form in graduates information and communication skills that will allow them to quickly perceive and process big information flows presented in various sign systems, to teach the use of modern means, methods and technologies of working with information sources. The European Parliament and the Council of the European Union in 2006 selected eight core competencies for the lifelong learning. One of these competencies is called digital. The basic knowledge, skills and competencies associated with digital competence are defined as: confident, critical and responsible use and interaction with digital technologies for learning, work and participation in the community. This includes information literacy and data literacy, communication and collaboration, creation of digital content (including programming and mapping), security (including knowledge of digital well-being and cybersecurity) and the solution of various problems, including economic, social and personal.

**Purpose.** The purpose of the study is the process of forming the subject competence of the student, consisting of the substantive component of geographical science–cartography.

**Material and methods.** In the process of research, we have used a combination of general scientific, general and special methods, including various levels (descriptive method, comparative method, statistical analysis, etc.). Since the rapid growth of information systems requires orientation of modern education to use

active learning technologies, we have also used cartographic methods that included digital, diverse sign systems and GPS technologies in our pedagogical research.

**Conclusions.** It is impossible to convey knowledge about yet unknown phenomena of nature or to teach students to construct and use the non-existent technique, there is one way – to form a search style of thinking, to instill interest and taste in knowledge and research, to develop the opportunity to see and appreciate the aesthetic side of evidence, to teach the general laws of the future activities, to equip methods of mastering and synthesizing new knowledge in any subject area, to create a broad communication outlook of a contemporary student. Work with cartographic materials at geography lessons has been highlighted in methodological recommendations by a number of scientists. Our task is to update this information.

**Keywords:** *geography teaching method; cartographic competence; geographic map; knowledge of cartography; ability to read the map.*

## Introduction

Modern humanity is in sign systems. Drawings, diagrams, topographical and geographical maps, numerical data, tables, formulas, signatures, inscriptions, texts, road signs, various types of conditional signals are all integral features of the manifestation of modern civilization. From the point of view of modern culture, signs play a large role, which has no expressive similarity with the object of the image (words are not similar to the objects in question, musical notes are not similar to music, money is not similar to goods, mathematical formulas that describe and allow to determine the course aircraft, not like the plane, or the trajectory of its flight, etc.). Thus, successful professional implementation requires special inclinations for immersion in the imaginary world of dry notation, for distracting from the real properties of an object of the surrounding world and focusing on information that carries certain attributes. When working with signs, as well as when working with any objects, monitoring, checking, accounting, information processing and the creation of new signs are necessary to make people feel safe in the environment.

Geography cannot be learned without using a variety of geographic maps. A modern lesson geography differs from other lessons precisely in the presence of a geographical map and work with it. At one time, the remarkable

geographer Nikolai Baransky aptly told about this (Baranski, 1990, p. 21-23). He emphasized the importance of a geographic map: “the map is the alpha and omega (that is, the beginning and the end) of geography”; “The map does not allow empty spaces; empty spaces on the map signal the failure of geographic research”; “The map contributes to the discovery of geographical patterns, that is, the laws of the distribution of space, correlation, combination and interaction of phenomena on the surface of the globe”; “The map is an intermediary between the researcher and the object of his research”; “Map” is the second language of geography, as a drawing in geometry “; “The map is not only a necessary means of research, but also an indispensable element of geographical representation”; “The map is one of the criteria of geography”; “Map – a tool for detecting geographical correlations”; “Map is a means of clarity”, etc. All geographic research begins with a map and returns to the map. On the basis of maps, the characteristics of the territory, countries are given, they measure, predict, analyze, summarize, draw conclusions. A geographical map is a symbolic representation of the earth’s surface on a scale plane. A geographical map is a representation of a model of the earth’s surface in a reduced form, containing a coordinate grid with symbols on a plane. Several maps are combined in a special guide–atlas. The map is a cartographic projection, a reduced generalized image of the surface of the Earth, another celestial body, or extraterrestrial space, which shows objects or phenomena located on it in a certain system of symbols. The map is a mathematically defined figurative and symbolic model of reality. Now any smartphone is equipped with GPS technology, navigator, etc. With the help of a program on a smartphone, you can find out where a particular object is located, for this you need to use information literacy, which allows you to communicate and collaborate. online through digital content (including programming) that provides some security (including digital well-being and cybersecurity competence) and solutions to various problems, including economic, social, and personal.

**Purpose.** The now puts certain tasks to give answers with help skills to adapt students to life in the information society through the development of information and communication culture by various information tools (textbook

paper and digital, educational books, television, radio, newspapers, magazines, directories, Internet, student and family environment, etc.), in order to give students, the opportunity to confidently solve various problems, including economic, social and personal.

**Material and methods.** In the scientific and pedagogical studies, two approaches to the interpretation of the notion “information culture” are traced: the humanitarian, which describes the main procedures for operating traditional printed information (textbooks, books, manuals, etc.) and technical, which is reduced to the use of the latest information technologies (digital disks, the Internet, interactive maps, electronic tutorials). The notion of “information culture” consists of the concepts of “communication”, “information exchange”, “dialogue”, “communication”, “communicative competence”, etc. In many cases, the concept of a communicative culture for communication is replaced, where it is reduced to the mere ability to receive and transmit information as a repeater. Almost in all cases, the concept of “communication” is based on skills and abilities, and occasionally – knowledge and, in general, no value orientations in the sense of communicative culture. Therefore, we propose the concept of “information culture” and “communicative culture”, not to divide, but consider them as an integrated concept – “information and communicative culture”. Thus, information and communicative culture is one of the components of a universal culture of a person, consisting of ideological information, a system of knowledge and skills that predetermine the purposeful creative activity of a person to meet individual information and communication needs and create a dialogue interaction with the environment where they are observed the relationship between nature and society.

## **Digital competence as a condition of communication**

Information technology education in a broad sense – is a complex of socio-pedagogical transformations associated with saturation of educational systems with information products, tools and methods; and in the narrow one – the introduction into educational institutions of the system of formation of information tools based on microprocessor technology, as well as information

products and pedagogical technologies based on these means. Information technology education does not crowd out traditional – the amount of “paper” and “numerical” information continues to grow. Gradually, a multi-level system of providing information on different media and in various sign systems, in which the traditional and information technologies interact closely, is developed. In connection with the emergence and development of many sign systems, which creates a multicomponent “information field”, there is a problem of informational (communicative) adaptation of man in society.

Among the specific socio-pedagogical problems, the central place is the contradiction between the pace of increase in knowledge in society and the limited ability of their assimilation by the individual. Attempts to solve this contradiction lead to the abandonment of the absolute educational ideal (fully developed personality) and the replacement of it with a specially determined educational ideal – the maximum development of human abilities with self-realization. It is necessary to ensure the right of the person to choose the directions of education, which leads to the introduction of sufficiently early differentiation of education and the creation of systems of continuing education. Realizing the idea of continuing education is possible only by preparing the necessary conditions for self-education: the creation of an organizational and legal basis for access to various sources of information, the formation and development of human abilities related to its search, processing, perception, understanding, use. A person who does not possess information technologies is deprived of one of the adaptation mechanisms in a dynamically developing society. There is a problem of formation and development of information culture of the individual through the formation of digital competence.

Analyzing the relevant experience of Turkish colleagues (Coach, Demir 2014) on cartographic literacy, we conclude that this urgent problem concerns modern society, since we often use maps in such activities as: ground sources and their distribution, preparation of development plans developed to process this data. valuable resources providing national defense and security, solving border problems, determining routes (highways, railways and oil pipelines or gas pipelines, etc.), and for this it is necessary to develop cartographic competencies among schoolchildren. (Coach, Bulut, 2014).

Encoding information on maps and deciphering this information and its interpretation are extremely useful not only in geography, but also in our everyday lives. The same topic is found in the works of other European geographers, who are not indifferent to the topic of cartographic literacy in schoolchildren. (Adams, 2009; Gould, 1991)

But, practice of informatization of institutions of general secondary education has raised a number of problems. One of the most acute (apart from material and organizational) is the problem of “resistance of teachers” to the introduction of information technologies into the learning process, caused by the contradiction between collective forms of learning, characteristic of a class-specific system, and the individualization of learning, which is stimulated by personal means (computer, laptop, smartphone, etc.). Another problem is the probable decrease in interpersonal contacts by expanding the use of depersonalized information. An important range of problems is related to the legal principles of disseminating information in the education system, namely: students’ rights to receive information, protection against the use of information about the student by other persons at his own expense and from unauthorized access to school databases; copyright and, in particular, the use for educational purposes of information prohibited for free distribution; protecting information from intentional and unintentional damage (for example, computer viruses), etc.

The use of digital technologies in geography and economics classes in the Lyceum is necessary to introduce instead of and in addition to other modern technologies. A student must be able to analyze independently, compare, describe, and for this he needs to be able to speak. Therefore, only machine control of knowledge for school is not suitable. However, even the most intelligent program is not capable of replacing observation in nature, the use of passages from works of art in the description of nature. But, for example, to descend to the bottom of the oceans of the world or to see the general circulation of the atmosphere from outer space will have to be far from everyone. It is in the knowledge of these places of the Earth that digital technology (in part, it’s even a smartphone) will become an assistant student and teacher. The use of multimedia tools when displaying images on a large

screen can greatly improve the visibility of learning. Mykola Baransky argued: “None of the study subjects requires such a degree of clarity and cognition as geography, and at the same time, none of the educational subjects represents a more favorable field for the application of visual and cognitive methods of teaching, as geography” (Baransky, 1990, p. 30).

## Requirements for information technology lessons

Each lesson or stage of training requires its type of software. When constructing training programs in geography, it should be remembered that:

- ▶ In the lessons of the mastering of new material, a demonstration program is required, which will allow the student to convey theoretical material to students in an accessible, vivid, visual form;
- ▶ In the lesson of consolidation of knowledge it is expedient to use controller programs, where students consolidate the acquired knowledge and necessary skills on this topic;
- ▶ In the control lesson, using a PC, the teacher can carefully check how much the student has learned a large amount of the material passed;
- ▶ At the lessons-workshops, students improve their ability to map maps, fill tables, draw conclusions, and work with statistical tables.

In the lessons of studying the new material or fixing the material you can use:

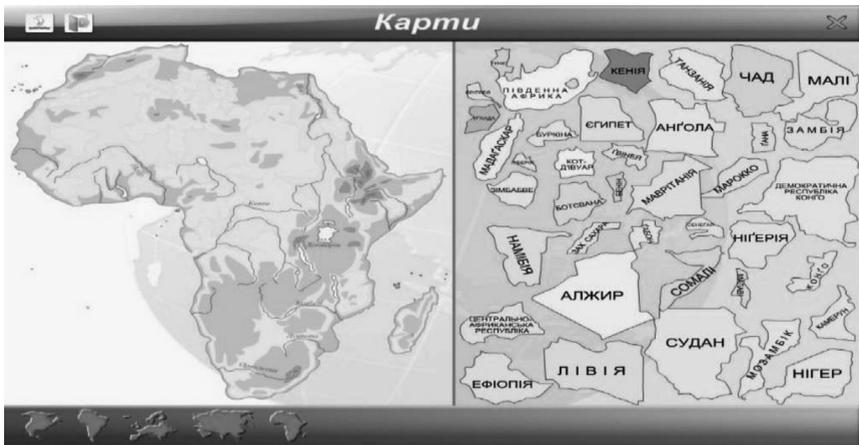
- ▶ multimedia guides – interactive background information from any object of nature with color photographs, videos;
- ▶ multimedia encyclopedias – interactive background information including color graphics, animation, sound effects.

For each job, the goal is defined, the task is developed. Students are asked to compare maps, fill in tables, draw conclusions. All practical work has a reference material. After performing the work, it is proposed to carry out control evaluation tests. To activate knowledge, you can include in the program game points, which enlivens the students’ perception of material, instill interest in studying the subject, improves creativity. For example, you can use interactive crosswords, or interactive maps, where students move one

finger in the continental space and apply it when checking, for example in the test mode. For example: test using images (geographic maps of the world, continents, countries, fragments of maps):

We will show this in the form of images that are taken from the interactive training manual “Training tests to prepare for external independent assessment”

**Fig. 1. Tutorial card element. Maps.**



Source: (Topuzov, Nazarenko, Kapirulina, 2008).

For example: on the left side of the screen is the “blind” map of the continent of Africa, and on the right is the countries located in Africa. It is necessary to fill in the “blind” geographical map with the help of a computer program. If a student incorrectly positions the country in the place where it should be, the program does not respond. Thus, regional geographical and cartographic competencies are verified.

Information technology education does not crowd out traditional – the amount of “paper” and “digital” information continues to grow. Gradually, a multi-level system of providing information on different media and in various sign systems, in which the traditional and information technologies interact closely, is developed. In connection with the emergence and development of many sign systems, which creates a multicomponent “information field”, there is a problem of informational (communicative) individual’s adaptation in society.

A little has changed since that time, when Nikolai Vasilyevich Gogol, a teacher of geography, and at the same time writer, wrote: “With existing methods of teaching geography is mostly a matter of memory, and therefore it is not surprising if the student for a short time is forgetting what was learned” (Krylovets, 2009, p. 43). Formation of geographical culture in students of the main school is impossible without a meaningful component of geographical science – cartography, which is part of cartographic literacy. This concept, by the definition of S. Bulanov, should combine the theoretical knowledge of students about the specific properties of the main types of geographical images, the ability to obtain geographic information from them, as well as knowledge of the location, relative dimensions, forms of the most important objects on the earth’s surface and the ability to create the simplest cartographic products (Bulanov, 2003, p. 74-75). A separate large unit in scientific and methodological research is the question of the introduction of geoinformation technologies in the school boarding school. The method of working with maps is presented in the Concept of studying geography at school (Topuzov, Nazarenko, Korniyev, Krugly’k et al., 2009, p. 15).

Work with cartographic materials at geography lessons in general secondary school’s Methodical recommendations were highlighted by P.S. Skavronsky (Skavronskiy, 2009, p. 32-37). O.Ya. Skuratovich, who has divided this process into three stages, has proposed a series of tasks for each of them, the process of forming pupils’ skills and abilities for the use of cartographic materials. O.Y. Skuratovich, as one of the main requirements for the organization of the educational process in geography, offers a comprehensive use of cartographic materials (geographic atlases, contour and wall maps, other cartographic products) in each lesson. As an independent methodological theme, the author singles out methodological requirements for working with wall maps (Skuratovich, 2000, p. 16). The introduction of cartographic tasks for all school geography courses forms the basis for the teacher’s creative activity regarding the creation of own collections of supplies and exercises for independent and practical work with cartographic works.

Teachers of geography and methodologists have accumulated some critical material on the study of geography through new textbooks and curricula. Today

wide discussion of all issues and aspects of further improvement of teaching of school geography has begun, including the balancing of quantitative and qualitative indicators of cartographic content in geographic education. Thus, largely from the optimal combination of the requirements of the curriculum, on the one hand, and the requests and capabilities of students, on the other, depends on the educational authority of the cartographic component of geographical education.

The content, structure and volume of cartographic material in the school course of geography in the main school are determined by the regulatory documents, first of all, the State standard of basic and complete secondary education. Requirements for pupils' knowledge in the state standard are presented in seven educational fields, including the natural sciences. The content of the geographical component of the field of natural science provides the formation of a spatial representation of the Earth.

State requirements for the level of geographic training of students include the ability to use plans, maps and other sources of geographic information. It is on the requirements of this document that the existing geography curricula are built. In our opinion, the effectiveness of the formation of cartographic concepts is significantly influenced by the content of the educational material, the sequence of study, its distribution by subject and individual courses in the curriculum on geography. A certain basic mapping level should be formed at the beginning of the study of the geography course, but this requires additional time and a variety of methodological approaches (*Derzhavnyj standart osvity v Ukraini*, 2004).

## Updated mapping tools should help schools

We have analyzed in detail the content of the cartographic component of geographical education of schoolchildren according to current textbooks on geography for the main school. Let's assume that this question is one of the key points in the geography course. Students are directly acquainted with the map in the 6th form when they begin to study a subject such as geography for the first time. But the violation of the logic of the presentation of educational material results in the inefficient assimilation of cartographic concepts, for example: educational

information is given about the world tour, the crossing of the zero meridian, the equator, the continents, etc., and the scientific geographic concepts of the “mainland”, “ocean”, “meridian”, “Equator”, “latitude”, “longitude”, “globe”, “card” are introduced in the months of the academic year, that is, the requirements for cartographic training, which set the curriculum for geography for the school, cannot be implemented without propaedeutic under students’ studies.

One of the important components of geographic education at the present stage of development of the Ukrainian school is the introduction of information and telecommunication technologies in the educational process. It’s been a decade since the students got the first, let them be simple and primitive, according to modern standards, pedagogical software products. The next step in computer support for teaching geography were the designers of the lessons with the functions of the application of various multimedia applications, expanded the possibility of application in the educational process of Internet resources.

Information technology (ICT) is being actively implemented in school geography, in particular, new cartographic means of teaching for students on electronic media have been created. The update requires a methodology for studying the basics of cartography in school geography courses. Back in 1997 at the 18th conference of the International Cartographic Association (ICA) in Stockholm, emphasis was placed on the problems of introducing telecommunication facilities in cartography and combining GIS technologies with the Internet. At the present stage, several theoretical concepts have been formed in cartography. At the same time, in the 90’s of the twentieth century began to form a new geofomation concept. According to it, cartography is considered as a science of system information-cartographic modeling and knowledge of geosystems. If we look at the current structure of cartography, it should be noted that it is not something frozen and unchanged. There are new branches. With the development of electronic computing technology, the search for new cartographic projections “took over” machines.

The emergence of global systems (GPS, in the Ukrainian version – GIS) has led to the creation of a new direction in mathematical mapping – satellite positioning. In recent years, Internet mapping has become a common place

affair. On the market of computer technologies, new hardware-software for cartographic Internet servers and Internet GIS appeared, and multimedia has become part of everyday life practice, when it is possible to calculate the location of a geographic search object using the help of a smartphone. coordinates.

The cardinal changes occurred in the geodetic provision of cartography: the global positioned systems became the main means of binding and ground surveillance, and aerospace surveys. High-precision digital technologies have proven to be most effective in creating topographic and thematic maps and digital terrain models. Thus, these changes relate to the main components of mapping: the method of data collection, designing techniques, drawing up, creating, presenting and disseminating maps. A well-known scientist-methodologist, cartographer A. Berlyant even introduced the term “pre-computer stage of development of cartography” thus emphasizing the entry of cartography into a qualitatively new period of development related to ICT (Berlyant, 2002, p. 45). All these changes should be widely reflected in school curriculum, in particular in the methodology of teaching geography at school.

Educational process in geography at school requires new cartographic resources in terms of content, forms, educational opportunities. Seventy-year cartography-geoinformatics are increasingly thinking about creating mapping tools that differ significantly from traditional maps and atlases.

Today, three-dimensional digital simulation helps build a bulk image, and animation gives the cards a dynamic aspect, and such images have already become widespread. However, questions arise that today there is no unambiguous answer. Should the card reader ever be over the card, see it at the top, does it make sense to place it on the map? Is partial or complete refusal of a symbolic image and a transition to a photo card correct? We believe that these questions will be answered when practitioners will be able to massively test the fundamentally new electronic cartographic products in their classrooms.

Our research shows that the problem issues that are “chasing” in decades’ school cartography, remain in the modern school. And if the question about the inclusion of relevant topics and sections of school cartography in educational

programs today is solved more or less satisfactorily, then the scientific and methodological support for studying cartography at school remains insufficient. The results of the study of the practical activities of geography teachers highlighted another important problem of school cartography. It turned out that to a large extent, the flaws in the formation of cartographic concepts are aggravated by the fact that for many decades, for educational purposes, the country does not issue topographic maps and plans of localities around schools. Almost all well-known methodologists emphasize the great importance of such maps (plans) for studying geography. They are much more intelligent than the pupils than small-scale maps, since they are less generalized, contain most of the large-scale conventional signs, they do not have the distortion-rhesus characteristic of small-scale maps. A vivid confirmation of the value of such an approach in the study of maps is the expression of a scientist-methodologist S.V. Bulanova: "To start immediately from such a complex symbolic image of a country that is a small-scale geographic map is just as wrong as compelling children to study in books intended for higher education institutions" (Bulanov, 2003, p. 89). It is difficult to disagree with the statement of R. Zemledukh: "Mapping cannot be taught verbal methods. It is necessary to constantly apply visibility, exercises with cards and other manuals" (Zemledukh, 1993, p. 251). In a monograph devoted to questions of the theory and methodology of the development of means of studying regional geography L. Zelenska discloses the relevance of the creation of regional cartographic products, proving its effectiveness during the formation of the geographical image of the territory (Zelenska, 1998, p. 57-59). Along with the technical and financial reasons that predetermined such a situation, a certain underestimation of the educational importance of such topographic maps in the national methodology of geography should also be mentioned.

We are convinced that today it is not enough to have educational pictorial maps or plans of non-existent territories in schools. Our research has shown that the effectiveness of studying cartography on local material with the use of topographical maps and town-planning plans where the school is located is much higher than in schools where traditional educational maps were used. The presence of such maps and plans (usually self-made) has become a significant

motivating factor, an additional stimulus to the study of geography and, ultimately, the motive for choosing the very geographic profile of education in high school. This situation is being addressed in our schools by inducing teachers and students to independently create plans for their area, in particular through field surveys. In our opinion, these types of practical work are possible in the basic school, but for the production of students suitable for use in the educational process, maps and plans need corresponding special courses, electives and appropriate training of the teacher of geography.

The curriculum sets the task of the student to be able not only to read maps and plans, but also to apply them in practical activities, to solve specific tasks. For example, mapping of the ecological situation in the village and its surroundings, the preparation of tourist trips, etc. (Navchal'ni programy` z geografii ta ekonomiky, 2017).

At the same time, without corresponding cards of these tasks the school will not perform. As a result of our research we can formulate the basic requirements for the properties and possibilities of future electronic topographic maps and plans for educational institutions: the scale of maps, plans should be at least 1:10 000; cartographic image can be edited, modified, supplemented by simple programs; maps and plans should be updated periodically over the Internet; it is necessary to create thematic maps on the basis of an electronic topographic contour map; to predict the possibility of a step change in the scale of a map or plan, putting in their content a different degree of generalization depending on the user-selected scale.

An important place in working with the map is the cartographic method. With its help, the teacher creates a cartographic image of the territory. One of the elements of this method is the ability to read the map. By the ability to read the map understand the ability to give a description of the territory and individual geographical objects on the basis of the map.

Cartographic component of mass geographic culture, which is formed during the study of geography in educational institutions, is cartographic literacy.

This concept, by definition, professor L. Datsenko, must unite combine the presence of students with theoretical knowledge about the specific properties

of the main types of geographical images, the ability to obtain geographic information from them, as well as knowledge of the location, relative sizes, forms of the most important objects on the earth's surface, and the ability to create simple cartographic works. Requirements to cartographic literacy of schoolchildren have changed several times. These changes were conditioned, mainly, by changes in the social order of the society to the cartographic preparation of students (Datsenko, 2011, p. 72).

A separate powerful unit in scientific and methodological researches is the issue of introducing into the school boarding school the achievements of geoinformation technologies, since their implementation can solve complex problems in all spheres of human activity that are related to the use of spatial information. The privilege of GIS technologies (GPS) in toponymical studies is the ability to visualize. GIS (GPS) involves the accumulation, analysis, systematization of toponymical information, creates new maps, which are in great demand in educational activities and tourism. The application of the geoinformation approach allows the storage of the latest, old and lost (historical) geographical names in the database. The peculiarity of using GIS-technologies during the construction of a toponymical database is the creation of interactive maps and the ability to include photographs, charts, diagrams, texts, etc. into the database (Audet, 1997, p. 293-300).

## **Digital competence as a condition of formation of geographical**

Cartography, as a field of exact sciences, has long been using mathematical methods and therefore earlier other Earth sciences began to use the capabilities of electronic computing machines (computers) to construct a cartographic image. Stacking cards using a variety of software and hardware has long surpassed the precision and design of traditional technology. However, it's a mistake to assume that digital cartography is a direct extension of traditional (paper) cartography and should be its exact copy. It developed in the general development of computer technology and is more informational product than cartographic. Traditional geographic skills acquire a new level in the use of spatial digital technologies.

In Ukraine, the necessity of active acquaintance of lyceum students with the basics of geoinformation systems (geoinformatics) and the essence of geoinformation technologies has long been over. According to the new Law on Education, the profile secondary education corresponds to the third level of the National Qualification Framework, which creates considerably better conditions for differentiated learning, taking into account the individual peculiarities of students' development, which differ primarily in qualitative composition of their abilities. It is expedient to have in-depth study of individual subjects, the widespread use of elective courses and electives, among which geoinformational education should take the leading role, which will provide opportunities for students to develop digital competence.

International studies conducted in Ukraine by the State Service of Quality of Education – TIMSS, PISA, PEARLS, etc., show that Ukrainian students quite well fulfill reproductive tasks, but show a low level of formation of general educational skills to work with code information presented in texts, tables, diagrams, drawings, diagrams, maps, etc. A large number of students do not perform the tasks in which they need to be answered in a free form, indicating the lack of development of adolescents in communicative skills necessary for forming their own thoughts, which should be presented in the form of a coherent verbal presentation (Nazarenko, 2013, p. 251-252).

Since the modern digital camera and even the smartphone is decorated with a modern digital camera, photographing any object in a digital photo displays information about geotagging (details of shooting). Examples of the tasks presented in the signatures to Figures 2-3 do not exhaust the possibilities of modern digital means and their use in the educational process from geography, because you can find places not only on a paper map but also on a satellite image, to execute the mini project “Going to rest from Kiev (fig.2) to the Odessa region (fig.3) – Tayirovo, Chornomorka-2, Ovidiopol'sky district”. Using data from photographs in a geography lesson, motivating students that they can solve a mathematical problem based on the Pythagorean theorem.

**Fig.2. Kyiv, Obolonska embankment” (using geotagging).**



*Source:* own work. Details of shooting: GPS Height: 97 m Latitude N 50 ° 30'15.715 "Longitude E 30° 30'55.462".

Possible questions: answer where the picture was taken? What time of year are we seeing? What can you say about the ecological features of the area? What measures should be taken to prevent the pollution of the Dnieper?

**Fig. 3. Odesa region (using geotagging).**



*Source:* own work. Details of shooting: GPS Altitude: 35 m. Latitude N 46 ° 22'12,958 "Longitude E 30° 42'06,821"

Possible questions: where is the picture taken? How do you see the landscape in the picture, for which area is it characteristic? What do you think, what coast of the sea is shown in the photo? Estimate the distance between the places made in photo 2. and photo 3. (photo 2-3 belong to the author of the article T. Nazarenko and were taken directly in those places, as evidenced by the content of the photos). If you do not have these photos in front of you, it will be difficult for you to answer such questions.

It is also important to use the BYOD concepts (Bring Your Own Devices) and Blended Learning here, which are now considered the most promising. One can conclude that it is expedient not only to in-depth study of individual subjects, but also the widespread use of elective courses and electives, among which the geoinformational education should be a prominent place that will enable the formation of digital competences in the lyceum students, will facilitate the updating of knowledge.

## Conclusion

In Ukraine, it has long been necessary to actively familiarize high school students with the basics of geo-information systems (geo-informatics) and geo-information technologies. According to the new Law on Education, secondary education corresponds to the third level of the National Qualifications System; this creates significantly better conditions for differentiated learning, takes into account the individual characteristics of the development of students, which are distinguished primarily by their qualitative abilities (*Zakon pro osvitu*, 2017).

It is advisable to in-depth study of individual subjects, the widespread use of elective courses and electives, among which geo-information education should take the main place, which will create opportunities for the formation of digital competence in high school students. Thus, considering changes in the content and structure of geographic cartographic education in Ukraine in recent years, we have come to the conclusion that the most urgent direction of the development of school cartography in the future will be the widespread introduction of information and telecommunication technologies, primarily GPS (GIS-technologies).

The emergence of a new digital cartographic product, on the basis of which programmable pedagogical tools are created, will stimulate the further development of the school geography methodology, the contents of which include cartography, as new teaching methods and organizational forms of education are being created. Geography through the map acquires spatial images. It is known—it is impossible to study geography without a map.

Detected disadvantages in the geographical preparation of students can be largely eliminated if in the learning process a predominant activity approach that is not based on the transfer of the advanced knowledge to the students, but forms the ability to acquire knowledge independently when working with any information. To do this, it is necessary to develop the adaptation skills of students in the information society through the development of information and communication culture by various information tools (textbook, manual paper and digital, educational books, television, radio, newspapers, magazines, directories, Internet, student and family environment, etc.).

Among the specific socio-pedagogical problems, the central place is the contradiction between the pace of increase in knowledge in society and the limited ability of their assimilation by the individual. Attempts to solve this contradiction lead to the abandonment of the absolute educational ideal (fully developed personality) and the replacement of it with a specially determined educational ideal – the maximum development of human abilities with self-realization.

The study does not exhaust all aspects of the problem of cartographic communication implementation. The scientific rationale deserves the development of technology teaching activities in an information society, students' adaptation to various digital gadgets, from mindless use to useful application goals and security.

## References

Adams, Paul C. (2009) *Geographies of Media and Communication. Critical Introductions to Geography*. Malden, MA: Wiley-Blackwell, Retrieved 20.11.2018 from: <https://trove.nla.gov.au/version/45928077>

- Audet, Richard H., Joshua Paris. (1997). GIS implementation model for schools: Assessing the critical concerns. *Journal of Geography*, No. 96(6), p. 293-300.
- Baranskyj, N. (1990). *Metodika prepodavanyya ekonomycheskoj geografyy [Methods of teaching economic geography]*. Moscow: Prosveshhenye, 303 p. (in Russian).
- Berlant, M. (2002). *Kartografia: uchebnik dlya vuzov [Cartography: a textbook for universities]*. Moscow: Aspekt Press, 336 p. (in Russian).
- Bulanov, S. (2003). *Problemy soverchenstvovaniya sistemy kartograficheskikh znaniy i umeniy v shkolnoy geografii [Problems of improving the system of cartographic knowledge and skills in school geography]*. (PhD Thesis). Moscow [From the funds of the Russian State Library]. 151 p. (in Russian).
- Gould, Peter. (1991) Dynamic Structures of Geographic Space. In *Collapsing Space and Time: Geographic Aspects of Communications and Information*. Edited by Stanley D. Brunn and Thomas R. Leinbach, London: HarperCollins, p. 3-30.
- Datsenko, L. (2011). *Navchalna kartografiya v umovax informatyzaciyi suspilstva: teoriya i praktyka [Educational cartography in conditional information support: theory and practice]*. Kyiv: DNVP "Kartografiya", 228 p. (in Ukrainian).
- Derzhavnyj standart osvity v Ukraini. [State education standard in Ukraine]*. Retrieved 20.11.2018 from: <http://zakon2.rada.gov.ua/laws/show/24-2004-%D0%BF> (in Ukrainian).
- Zakon pro osvitu (05.09.2017)*. Retrieved 20.11.2018 from: <https://zakon.rada.gov.ua/go/2145-19> (in Ukrainian).
- Zelenska, L. (1998). *Teoretychni i metodologichni osnovy stvorenya zasobiv navchannya geografii (regionalnyi component) [Theoretical and methodological foundations for the creation of geography teaching tools (regional component)]*. Dnipropetrovsk: Vydavnytstvo Dnipropetrovskogo universytetu, 244 p. (in Ukrainian).
- Zemledukh, R. (1993). *Kartohrafiya s osnovamy topohrafiy: uchebnoe posobyie [Cartography with the basics of the topography: a tutorial]*. Kyiv: Vyshcha shkola, p. 456 (in Ukrainian).
- Kornyeyev, V., Kruglyk, L., Nazarenko, T., Topuzov, O. et al. (2009). *Koncepciya navchannya geografii v shkoli [The concept of studying geography at school]*. *Pedahohichna presa: Geografia i osnovy ekonomiky v shkoli*, No. 7-8, p. 15-21 (in Ukrainian).

- Koç, Hakan & Selçuk Beşir Demir. (2014). Developing Valid and Reliable Map Literacy Scale, Volume 4, Issue 2, pp. 120-137. Retrieved 20.11.2018 from: <http://dergipark.gov.tr/rigeo/issue/40894/493735>
- Koç, H. & Bulut, İ. (2014). Environment and Life in the Mediterranean, International Congress of Turkish Association of Geographers, 4-6 June 2014, Muglia Sitka Cotman University, Turkey.
- Krylovets, M. (2009). Mykola Gogol yak geograf [Nikolai Gogol as a geographer]. *Pedahohichna presa: Geografia i osnovy ekonomiky v shkoli*, No. 3, p. 42-44 (in Ukrainian).
- Navchalni programy z geografiyi ta ekonomiky [Training programs in geography and economy]* (2017). Retrieved 20.11.2018 from: <https://mon.gov.ua/ua/osvita/zagalna-serednya-osvita/navchalni-programi/navchalni-programi-dlya-10-11-klasiv> (in Ukrainian).
- Nazarenko, T. (2013). *Metodyka navchannia geografii v profilnii shkoli: teoriia i praktyka [Methodology of teaching geography in profile school: theory and practice]*. Kyiv: Pedagogichna dumka, 318 p. ISBN 978-966-644-362-8. Retrieved 20.11.2018 from: <http://lib.iitta.gov.ua/id/eprint/9886> (in Ukrainian).
- Skavronskiy, P. (2009). Zmist i struktura ponyattya “kartografichna kompetentsiya” [Content and structure of the concept of “cartographic competence”]. *Pedahohichna presa: Geografia i osnovy ekonomiky v shkoli*, No. 6, p. 32-37. (in Ukrainian).
- Skuratovich, Y. (2000). *Robota z kartografichnymi materialamy na urokakh geografii v zagalnoosvitnykh navchalnykh zakladakh [Work with cartographic materials at geography lessons in general educational institutions]*. Kyiv: NVP “Kartografia”, 16 p. (in Ukrainian).
- Topuzov, O., Nazarenko, T., Kaporulina, S. (2008). *Trenuvalni testy dlya pidgotovky do zovnishnogo nezalezhnogo ocinyuvannya z geografiyi (z dyskom) [Training tests for preparation for external independent evaluation from geography (with a disk)]*. Kyiv: DP “IPTP”. Retrieved 20.11.2018 from: <http://rozumniki.net> (in Ukrainian).

*Received: 20.10.2018*

*Accepted: 01.02.2019*