DOI:10.59787/2413-5488-2025-49-1-5-19

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DEVELOPMENT OF MAP READING SKILLS OF FUTURE GEOGRAPHY TEACHERS

Abstract: Map reading skills are considered one of the subject competencies of future geography teachers. Scientific sources and works of foreign scientists related to the concept of map reading skills were analyzed. The purpose of the study is to develop map reading skills of future geography teachers through PDCA stages “plan-do-check-action". The PDCA stages method was used in the research to develop map reading skills. Each stage should be started with proper planning of the works to be done with the geographical map. The tasks associated with the map are constantly executed and the actions during execution are checked for correctness or incorrectness. Actions associated with the map should be repeated to improve. It was found that map reading skills can be developed if future geography teachers repeat these stages. As a result of the research, it is possible to develop the map reading skills of future geography teachers by reading the symbols of the geographic map, understanding conventional signs, and performing practical work related to the map. Types of geography tasks for development of map reading skills were offered.

Keywords: map reading skills, map use, geography teacher, geographic map, map analysis.

Introduction

People use map widely and frequently in their daily life. That's why today the map is a communication tool that shows where and how to look for information and is modern in terms of application. A map is a miniature representation of reality and consists of a representation of space (Bjerva&Sigurjonsson, 2016). A map as a graphical representation of the environment that shows the relationship between geographic objects (Kimerling et al., 2016). A map is the language of geography. It is the main tool for displaying statistical data in the field of geography. The use of maps facilitates the identification and interpretation of geographic patterns (Daniel Adrian et al., 2020). ArcGIS StoryMaps geospatial technologies are widely used for mapping in geographic education and research (Caquard et al., 2017; Lee, 2020). StoryMaps, a multimedia platform for online maps with interactive functions based on the theories of geographic visualization, is often used in the educational process (Jakob et al., 2022).

Maps and digital atlases necessary for the process of geographic education are created using ArcGIS Online. This can be a prerequisite for the formation of spatial thinking and geographical knowledge of students, as well as the development of map reading skills. The use of geospatial technologies in the educational process increases the effectiveness of the geography curriculum (Rafael et al., 2020). Research shows that Web cartography is the most effective in developing spatial thinking. The value of Web cartography is important in geographic education.

This, in turn, can be the basis for the development of map reading skills of future geography teachers through a spatial thinking approach (Steven et al., 2014). Reading skills are important in solving current geographic problems. They are widely formed and developed in geographic education. Scientists have conducted scientific research on the development of map reading skills of teachers in solving geographic problems in geography lessons. The results of the study

showed that the map reading skills of school teachers were weakly developed before they were employed, and teacher-oriented teaching type prevailed (Tomas et al., 2023).

It helps to review information in a highly effective way with the help of skills in making the right decisions on the questions necessary for human life. In the social studies curriculum in Turkey, mapping skills are called «spatial skills» and are among the basic geographical skills. The results of Nazlı Gökçe's research showed that students' skills in working with maps are weak. She proposed the need to constantly repeat and improve working with the map in a practical sense (Nazlı, 2015).

To determine the literacy skills of social studies teachers, researcher İneç Zekeriya Fatih used a virtual map application integrated into a geographic information system. Qualitative research method was used in the research work, future teachers' attitude to skills was evaluated by content analysis, reflection skills were evaluated by descriptive analysis. The results of the study showed that the cartographic literacy of teachers was mainly in the direction of understanding the interpretation of symbols, finding coordinates, measuring distance, determining the direction, reading the map (İneç, 2021).

Scientists found that using Google Maps, students can take a two-dimensional (2D) image of the terrain and convert it into a 3D image. If the geography teacher uses them in the lesson, it is noticed that the participation of the students in the lesson will improve. By creating 3D models, students can learn the concepts of horizontal topography. Three-dimensional visualization of the local area can be explored through virtual reality and its possibilities to promote the development of spatial skills have been identified. This will improve map reading skills of future geography teachers. (Carlos, 2017). The flipped classroom method is used to teach GIS technologies in the development of students' geospatial competencies in higher educational institutions. The results of the study showed that this experience allows students to develop and implement their ability to work with maps. (Tian et al., 2022). Reading and using a map to improve students' analysis of specific examples, development of reflective thinking, and research skills in the process of geographic education widely used (Daley, 2010).

Geography textbooks play an important role in the formation of map reading skills. Textbooks are the most important reference tool for developing map reading skills. It can be seen from Gürgil's research that the skills characteristic of geography teachers include the interpretation of tables, graphs and diagrams. (Gürgil, 2018). ICT has entered all spheres of humanity. The use of information and communication technologies in geographical education is effective. The introduction of ICT into the educational process helps to better understand and master the subjects. ICT is a new subject, new skills necessary for students.

Today, it is impossible to imagine life without the use of ICT and it is a widely used tool in teaching and learning. Using ICT in the classroom and performing activities often forms and develops the student's map reading skills (Froilan et al., 2019). Teachers should be able to compose teaching materials in geography using various online programs. Working with digital resources contributes to the effectiveness of learning outcomes. Other scientists have shown in their research that working with online programs can be a starting point for the development of study skills (Fitra et al., 2022).

Researcher showed that the frequency of map use during geography lessons contributes to the development of map skills and the level of students' interest in geography will increase (Aksoy, 2019).

Map reading skills are very important for future geography teachers. It consists of activity components such as map reading, map application, map analysis and map interpretation. Map reading skills are implemented through the activities of working with types of geographic maps in basic and visual subjects in the structure of the educational program for the training of geography teachers. Even after the map reading skills have been developed as a professional, the school continues to teach the geography course. The purpose of the study is to develop map

reading skills of future geography teachers through PDCA stages «plan-do-check-improve» activities.

The problem of the research is that future geography teachers do not fully master map reading skills in working with types of maps, being able to read the map correctly, getting and processing information from the map.

Literature review

A sufficient level of knowledge and skills of map users to process the content of the cartographic product begins with the formation of cartographic skills at school. The acquired knowledge and skills are combined with professional training and improved (Kristien, 2016). Map reading skills are important not only in professional training, maps are used in everyday life for various purposes, from teenagers to adults. Such research may include a comprehensive review of the literature on how people develop map reading skills from adolescence to adulthood.

Based on Fisher's theory of skills, the interests of three map-related research communities, i.e., cartographers, cognitive psychologists, and educational researchers, were analyzed according to the research task. It can be seen that many scientific studies have focused on map usage rather than map reading skills development. The effectiveness of map usage skills is directly related to map reading skills. This can be seen from research findings that map reading skills can be developed by combining different skills (Leilani, 2023). There are research works on developing map reading skills through practice-oriented tasks in the learning process. By using sports orientation based on active practical activities, you can develop map reading skills. This study used an analytical rubric consisting of four criteria: direction/location, sign/symbol recognition, use of landforms, and time management. As a result of the study, it was found that the most complex map reading skill is determining the direction/location, and the simplest skill is determining the landforms (Uyar et al.,2022).

In education, it is important to work with concepts, explanations, definitions related to map reading skills. It has been determined that terminology is often the influencing factor in the construction of the map (Havelkova et al., 2019).

The ability to correctly obtain information from the map, find it and correctly recognize conventional signs has a positive effect on the development of map reading skills. Failure to correctly interpret a map can have major consequences in making quick decisions. The experience of map readers is an important and decisive factor in understanding the map. Factors such as their age, education, and gender have been shown in studies to contribute to interpretation. Experienced readers have been known to make frequent mistakes in geographical names when reading a map. In the results of the research, it was determined that special attention should be paid to symbols and placement on large-scale maps. This showed that future errors in map reading can be prevented (Szigeti-Pap et al., 2023).

Maps are the main source of information, so it is very important to develop the skills of students to work with maps. In this study, it was determined that the teacher and his/her actions of working with the map are the most important factor in the selection and development of map reading skills. As a result of the study, three types of teachers were identified: «Navigators», «Problem-oriented», and «Resource-oriented» based on a survey and interviews among Czech teachers. This will help future geography teachers to develop their map reading skills and help them become professionals. Map reading skills are required when using maps, plans, and geospatial information. Terrain is represented on a map using two-dimensional (2D) and three-dimensional (3D) cartographic methods (Havelková & Hanus, 2019).

In order to solve the difficulties in the interpretation of this information, «6B01515-Geography teacher training educational program» is provided in specific subjects (toponymy, etc.). Researchers found out that electronic maps are an active teaching tool, and showed that

students' map reading skills have expanded in class. It helps students develop critical thinking and visualization skills in communicating ideas through video (Ellozy et al., 2010).

Other scientists have compared the effectiveness of paper maps and electronic topographical maps in the formation of reading skills in their research. As a result, it became clear that the indicators of the students' map reading skills used in creating the two types of maps did not make much difference. The results of the research revealed that their learning progress and teaching style were not related to each other. As for the conclusions drawn from this, working with paper and electronic maps develops and strengthens map reading skills (Pedersen et al., 2005).

Hsiao-Ping Hsu and other scientists examined the effectiveness of the teacher's use of Google Earth in the classroom in the formation of topographic map reading skills of students. It can be seen from the results of the study that the topographic map reading skills of students with the help of Google Earth have improved somewhat compared to traditional teaching. This is explained in connection with the 3D visualization of the terrain and the availability of knowledge and skills of the learners about landforms in Google Earth. Activities often performed with such online services develop map reading skills (Hsiao-Ping Hsu et al., 2018). Ali Demirci, Ahmet Karaburun & Hatice Kılar examined the effectiveness of Google Earth as an educational tool in high school geography classes in their research. Interactive exercises on the types of formation of shores were created in Google Earth, and students performed them on their computers according to the instructions. It can be seen that the actions of completing such tasks affected the progress of the students. This study showed that Google Earth can be an effective educational tool only if it is used correctly for the purpose of the lesson, the material and the methods. The use of Google Earth as an educational tool of future geography teachers will contribute to the development of map reading skills (Demirci et al., 2013).

In order to assess the cartographic skills of students of all study periods, the researchers conducted several cartographic surveys. In the questionnaire, there are tasks about drawing point, line and district objects on the map. Based on the cartographic methodology, the students' skills were analyzed and evaluated through mental sketches. Research results are used in the process of evaluating the effectiveness of teaching (Nieścioruk, 2023). An online survey was conducted among Czech teachers about the use of school atlases as an integral part of geography education. The study was focused on the frequency and importance of using atlases, and the types of tasks that are often performed with the help of atlases and using additional educational tools were determined. The results of the study showed that 90% of the participants use atlases in daily lessons or every lesson. It was found that teachers with more experience used atlases more often than teachers with less experience. Teachers find thematic maps to be a problematic part of the atlas. The study made it possible to assess the importance of the atlas in geographic education. Carrying out more activities related to geographic atlases in geography education can develop the map reading skills of future geography teachers (Beitlova, 2021). Working with maps is important in geographic education. In pedagogical education, students have many difficulties in map interpretation and geological data analysis. Doing tasks using Google Earth will improve students' map reading skills and geographic thinking skills (Ilkka Ratinen & Tuula Keinonen, 2011).

The map of the world is created interactively in the application of the geoinformation system. In the research work, the process of transforming information by teachers with the help of real data was evaluated. The research project used a technical, scientific and collaborative approach. The results of the study showed the need to use high-level thinking skills in teacher training in structuring and systematizing real data (İneç, Z. F., Akpınar, 2020). Conducted research in the direction of developing spatial thinking skills of students through geographic information system. This, in turn, can be the basis for the formation of map reading skills (James Hickman, 2023).

Methods and organization of research

As a research tool, a structured questionnaire was compiled in Google Form, and its link was distributed to the respondents via WhatsApp to the respondents-students of the 2nd year bachelor's degree in geography at the Abai Kazakh National Pedagogical University located in Almaty. 47 students voluntarily participated in this questionnaire and answered within the specified time. The structured questionnaire consists of two parts: the first part contains demographic data of student respondents, and the second part contains questions related to map reading skills. 63,8% of the survey participants were women (30 students), and 36,2% were men (17 students) (see Table 1).

Table 1

Gender structure of survey participants

		Frequency	Percent
Valid	female	30	63.8
	male	17	36.2
	Total	47	100.0

Students of different ages participated in the survey. If we analyze the age of the participants, the number of students under 17-18 years old is 5 (10.6%), the number of students under 19-20 years old is 40 (85.1%), the number of students under 21-22 years old and older is 2 (4.3%) (see Table 2).

Table 2

Age structure of survey participants

		Frequency	Percent
Valid	17	5	10.6
	19	40	85.1
	21	2	4.3
	Total	47	100.0

Students were asked 3 questions in the survey to determine their baseline level of map reading skills. To determine map reading skills, the survey results were analyzed using the SPSS statistical program.

«What information do you get from geographic maps?» to the first question in the survey, 39 students (83%) answered only about geographical objects, 6 students (12.8%) about spatial data, 2 students (4.3%) about processes and phenomena (see Table 3).

Table 3

What information do you get from geographic maps?

		Frequency	Percent
Valid	Geographical objects	39	83.0
	Processes and phenomena	2	4.3
	Spatial information	6	12.8
	Total	47	100.0

It can be seen that the vast majority of survey participants are limited only to finding geographic objects on the map page. Lack of skills in geographic space and spatial thinking can hinder the development of map reading and analysis skills. In the case of the given question, students should be trained to think spatially and get spatial information while reading the map.

«Assess your reading skills in determining coordinates on a geographic map?» 13 students (27.7%) answered the second question as high, 4 students (8.5%) as average, 30 students (63.8%) as satisfactory (see Table 4).

Table 4

Your reading skills in determining coordinates on a geographic map

		Frequency	Percent
Valid	Average	4	8.5
	Satisfying	30	63.8
	Very good	13	27.7
	Total	47	100.0

Therefore, it can be seen that the vast majority of students have a satisfactory level of map reading skills. It can be seen that there are problems in the development of students' map reading and analysis skills at a high level.

«What is the problem when working with geographic maps?» to the third question in the survey, 19 students (40.4%) indicated in their answers that they have difficulties in scale transformation, 16 students (34%) in understanding features of the terrain, and 12 students (25.5%) in working with conventional symbols of the map (see Table 5).

Table 5

What are the challenges when working with geographic maps?

		Frequency	Percent
Valid	Working with conventional signs	12	25.5
	Scale transformation	19	40.4
	Understanding the features of the terrain	16	34.0
	Total	47	100.0

Most of the students still do not have enough skills to work with the scale of the map. The physical map lacks the skills of working with isogyps lines in determining terrain features. It can be seen that map reading skills are insufficiently developed in determining the geographic latitude and longitude of the object on the map.

Based on the analysis of the results of the survey, it was revealed that there are a number of difficulties in the development of map reading skills of future geography teachers. Map reading skills are considered the most important in daily lessons and educational and research activities. Because an important way to develop map reading skills is through paper map and electronic map activities. Any geography teacher's activity should start with a map and end with a map.

In the survey «What information do you get from geographic maps?» to the first question, the vast majority of respondents indicated that they can get information about geographical objects from the map. This is a basic level of map reading skills. It can be seen that reading

skills are formed at an insufficient level in obtaining information about the spatial location of geographical objects. Students should increase activities aimed at studying geographical phenomena and processes from the map. Learning how to find differences in geographical phenomena and processes on a map will have a positive effect on the development of students' map reading skills.

Presented in the survey «Assess your reading skills in determining coordinates on a geographic map?» to the question, most of the respondents answered that it was at a satisfactory level. It is necessary to offer more tasks aimed at teaching ways of calculation using the geographic coordinate system, geographic latitude and longitude map. When the algorithm for determining geographic coordinates is properly presented, by using more maps in the classroom and determining the geographic coordinates of the local area, the map reading skills of students will undoubtedly develop at a higher level in the future.

Presented in the survey «What are the difficulties when working with geographic maps?» to the question, the respondents mentioned that they have difficulty working with the scale. Any map is made to scale. Students' map reading skills can be developed at a higher level if tasks aimed at working with types of scale, with a physical map, and more tasks for reading the system of conventional map markings are offered.

Organization and methods of research

Teachers plan and conduct lessons according to the PDCA (plan-do-check-act) cycle. Research participants used frames to interpret student data. The results of the study showed that it had a positive impact on their professional development (M. Dam et al., 2020).

Prospective chemistry teachers used the four phases of PDCA (preparation, execution, verification, evaluation, and observation) in metacognitive teaching strategies to explain phenomena scientifically to students. The result of the study showed that this strategy is effective in explaining in depth the connection between mixed concepts of natural sciences (Parlan et al., 2018).

The PDCA concept "plan-do-check-act" is used in the implementation of case methods in the higher education system of Taiwan. The results of the study showed that this concept had an effective effect (Ruey, 2012)

Online learning has become a major trend in education. It is necessary to develop the online teaching competence of university teachers. The planning, implementation, and improvement stages of PDCA strongly helped teachers adapt to the virtual learning environment. Activities during this period directly affected the quality of teaching, continuous improvement improved teachers' online teaching skills (Chi et al., 2023).

The teacher used the "plan-do-check-act" (PDCA) cycle when performing the team task in the classroom and analyzing and evaluating it. The result of the study showed that the PDCA cycle significantly contributed to the improvement of students' team skills (Morgan et al., 2017).

In our research, we will develop the map reading skills of future geography teachers through the four phases of PDCA (planning, doing, checking, improvement).

Stage 1 of developing map reading skills «Planning»

Stage 2 of developing map reading skills «Doing»

Stage 3 of map reading skills development «Checking»

Stage 4 of map reading skills development «Improvement»

Stage 1 of developing map reading skills «Planning»

In geographic education for the implementation of activities related to planning:

- choose the type of map and familiarize yourself with its scale and conventional signs;
- ways to work with the map;
- map work;

- it is necessary to plan the preparation of the necessary cartographic materials.

Types of activities performed during the «planning» stage: choosing the necessary types of resources (physical map of North America, or geographical atlas of North America, handbooks, dictionaries, encyclopedias), familiarizing with the name of the map, conventional signs, scale. Finding large geographic objects from a physical map or geographic atlas of North America, distinguishing object types, classifying them into semantic subgroups: mountain (Appalachian, McKinley), river (Mississippi, Missouri, Rio Grande), lake (Athabasca, Winnipeg, Huron), sea (Sargass), ocean (Atlantic, Pacific)).

Using the map, based on the analysis of the composition of geographical names in North America, it is possible to distinguish 5 main semantic subgroups of toponyms: oronyms (denoting the characteristics and types of terrain); potamonyms (river names); limnonyms (names of lakes, ponds); pelagonyms (names of the sea and its parts); oceanonyms (names of the ocean and its parts).

At this stage, students choose the type of map to perform the task, get acquainted with its scale and conventional signs. Prepares the necessary cartographic materials in advance. Therefore, students can determine the type of map they need, get acquainted with the types of scales, the system of conventional symbols, and properly plan their work with the map. As a result, students' enthusiasm for map reading increases and their map reading skills develop.

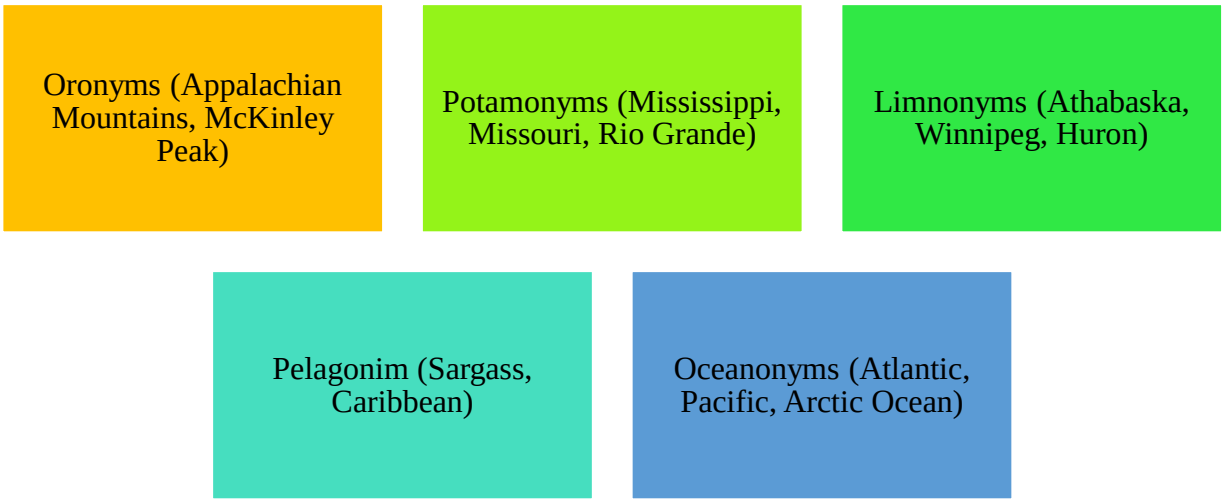
Stage 2 of developing map reading skills «Doing»

- perform actions related to map scale conversion;
- implementation of tasks to be done with maps.

Actions performed during the «Doing» phase: carrying out work related to the map according to the plan, providing instructions, giving advice on the task related to the map. Tabulate the list of toponyms in North America by types of objects, write down the meaning of the names of geographical objects. Interpretation and Image Mapping of North American Toponym Groups (see Figure 1).

Figure 1

Toponym groups



To analyze and compare the meaning of the names of mountains, rivers, lakes, seas, oceans in North America, connecting them with their location on the map. Write the names of major geographic features of North America on a picture map (for example, the name of a river in blue). At this stage, students perform toponym mapping activities. Performs practical tasks related to the map. As a result, students' map reading skills will develop.

The 3rd stage of map reading skills development «Checking»

- collection and processing of information about map works;
- working with the results of the work done with the map;
- to analyze the work done with the map;

Actions performed during the «Checking» period: viewing and checking the results of work performed with the map, analysis and processing of work results.

At this stage, students check the results of the tasks performed with the map again. He sees the progress of his work. At this stage, the teacher checks and evaluates the work done with the image map.

The 4th way to develop map reading skills «Improvement»

- consider ways to improve the work done with the map;
- to improve the level of performance of tasks related to the map;

Actions performed during the «Improvement» stage: making recommendations or decisions aimed at improving the results of the work performed related to the map, showing responsibility. Stay up-to-date with information on changes in geographic names in North America. Find and view the names of newly appeared geographic features on the map. Explain the meaning of the name.

At this stage, students take into account the shortcomings of the work done with the map and consider ways to improve it. Constantly repeats actions in order to improve the level of performance of the task.

The results of the study and their analysis

Before the research work, 47 students were asked to perform tasks related to maps using the traditional method. Before the experiment and after the experiment, the results of the task were processed in the SPSS program. The final result of control work of experiment 1 was obtained at 8 weeks, and the final result of control work of experiment 2 was obtained at 15 weeks. Students were given tasks and test questions for reading the map. For 7 weeks, the students completed the tasks for reading the geographical map according to PDCA stages. The results of the two interim monitoring were analyzed and processed by SPSS (see Table 6).

Table 6

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Points before experiment	69,62	47	18,464	2,693
	Points after the experiment	83,04	47	8,003	1,167

From the data analysis carried out in SPSS, the following can be seen:

- The average score of students before the experiment was 69.62 with a standard deviation of 18.464.
- After conducting an experiment with the formation of skills in reading geographical maps, the average score of students increased to 83.04 with a standard deviation of 8.003.

It is important to note that the standard deviation for the average score after the experiment decreased significantly compared to the original data. This may indicate that students performed more consistently after the training.

Based on the data obtained, we can conclude that the conducted pedagogical experiment on developing geographic map reading skills among 2nd year students was positively effective. The increase in mean score and decrease in standard deviation after the experiment suggests that the training did have a positive impact on the students' level of preparation in this field.

Pairwise correlation was used to analyze the test results before and after the experiment on map reading skills. The correlation between the scores before and after the experiment was

0.817, which is a fairly high indicator. P -values less than 0.001 for both one-tailed and two-tailed tests indicate statistical significance of this correlation (see Table 7).

Thus, based on the results of the analysis by the SPSS program, we can conclude that there is a strong positive correlation between students' scores before and after the experiment on developing geographic map reading skills. This suggests that students made significant progress in mastering these skills after 7 weeks of specific tasks and training.

Table 7

Paired Samples Correlations

		N	Correlation	Significance	
				One-Sided p	Two-Sided p
Pair 1	Points before experiment Points after the experiment	47	,817	<,001	<,001

From the data presented in the table, a t-test was used to analyze the test results before and after the experiment on map reading skills (see Table 8). According to the t-test conducted, the mean value of the difference between the scores before and after the experiment is -13.426. Thus, on average, participants in the experiment showed a decrease in results after completing a training course in reading geographic maps. The standard deviation of the difference between scores was 12.785, which indicates a spread of data around the average value of changes in scores. The standard error of the mean of the difference is 1.865, which indicates the accuracy of the estimate of the mean change in scores. The confidence interval for the difference between the scores before and after the experiment (95% confidence interval) was -17.179 to -9.673. This means that with a 95% probability the average difference between scores will be in the specified interval. Thus, based on the results of the analysis by the SPSS program, we can draw a conclusion about the dynamics of changes as a result of testing students before and after the experiment on reading geographic maps. Participants' average scores dropped by 13,426 points, a change that was statistically significant.

Table 8

Paired Samples Test

		Paired Differences			
		Mean	Std. Deviation	Std. ErrorMean	95% Confidence Interval of the Difference
					Lower
Pair 1	Points before experiment Points after the experiment	-13,426	12,785	1,865	-17,179

Research results and their discussion

Task performance activities for each stage of map reading skill development were considered to achieve the research objective. Analyzing the research results, the effectiveness of developing map reading skills of future geography teachers was determined.

Map reading skills can improve students' geographical culture and cartographic knowledge, develop the ability to work with maps, map reading, work with the system of conventional signs, map scale conversion, map task performance activities. Because it allows them to plan their preparations.

World experience proves the need to be able to read maps in continuous education in geography. Artvinli & Dönmez found in their research that school geography textbooks influence the level of cartographic skills, enable critical thinking and problem solving, and that maps are a means of communication. Research has shown that people with map skills can easily navigate in unfamiliar environments and can create and analyze global maps. The concept of skills is considered to be important in all stages of learning for a person's life (Artvinli & Dönmez, 2020). It is very important to use information and communication technologies and platforms in the development of map reading skills. Ineç Zekeriya Fatih assessed teachers' skills through content analysis, and reflective skills through descriptive analysis.

In order to study the cartographic literacy of teachers, the task of transferring the world map to an interactive and dynamic environment has been completed. As a result, the information obtained from the virtual map determined the basis of the cartographic literacy of teachers to understand and interpret symbols, determine the coordinates of the place of residence, measure the distance, and read the map. (Ineç, 2021).

Cartographic education of higher educational institutions has a systematic character within the curriculum and plays an active role in the formation and development of map reading skills. Naeema Mohamed Dawood Alhosani & M.M. Yagoub's research examined students' skills in map reading, designing, understanding directions, and calculating distances. As a result, the strengths and weaknesses of the geography curriculum in the formation of skills were identified and the need for revision was shown. Recommendations for improving geographic skills are provided in the research paper (Naeema & Yagoub, 2015).

We believe that it is necessary to strengthen the system of tasks aimed at reading, understanding, using, analyzing and synthesizing a geographical map in the content of visual subjects in the «6B01515-Geography teacher training program».

He studied the impact of map reading on the professional growth of teachers and strengthening their academic skills and competencies. This, in turn, improves students' academic results (Moles et al., 2016). Map reading skills are based on navigation, measurements and visualization, which builds cartographic literacy in students. To read a paper map or electronic map, one must begin by understanding the conventions and symbols. Only then can cartographic literacy be developed. Gillian Kidman & Chew-Hung Chang show in their research that it will develop (G. Kidman & Chew-Hung Chang, 2019).

Based on the results of this study, it can be said that the PDCA stages of «plan-do-check-improve» can be a method and a reliable tool for developing map reading skills. The results of the survey revealed that students have difficulty in recognizing conventional signs and symbols, working with a scale, and determining geographic coordinates when reading a map. Da Silva suggested the development of map symbol recognition using interactive digital games (Da Silva, 2015).

And we have shown that by mapping nomenclature, mountains, rivers, lakes and other geographical objects, activities to understand geographic coordinates and recognize symbols develop map reading skills.

During the discussion of the results, we can conclude that the method of «planning-executing-checking-improving» method of «PDCA» proposed as a methodical aid to students can develop map reading skills. This method contributes to improving the experience of teachers working with maps and developing their professional competences. If all stages are carried out in sequence, systematically and according to requirements, it is possible to get positive results in future research work. Effective development of map reading skills of future geography teachers leads to the formation of cartographic competence. Allows for increased ability to perform a problem or task associated with any map.

Conclusion

A review of the works and research works of foreign scientists on the issue of developing map reading skills in the training of future geography teachers was made. As a result of the analysis of foreign experiences and works of scientists, it was determined that map reading skills are a very important skill in the formation of professional competence of geography teachers and that map-related works should be systematically taught in the visual subjects of the university curriculum. The research focused on the stages of development of map reading skills of future geography teachers. These stages allow you to carry out map activities in a systematic manner. The results of the conducted research, according to the scientific researches and works related to the topic, «map reading skills» form the basis of the basic subject competencies of future geography teachers. Map reading skills are developed by regular practical work with a geographical map. These activities should be carried out regularly. The importance of developing map reading skills will contribute to the formation of cartographic competence of future geography teachers.

Funding Information

This research work was carried out within the framework of the scientific project AP15473403 "Methodical foundations of the formation of cartographic competence of future geography teachers" under the project "Young Scientist" for 2022-2024, financed by the Committee of Science Ministry of Science and Higher Education of the Republic of Kazakhstan.

Conflict of Interest Statement

The authors declare no potential conflicts of interest regarding the research, authorship, or publication of this article.

Author Contributions

Beikitova Albina: Data curation, Writing - Original draft preparation, Software, Supervision, Writing- Reviewing and Editing, Investigation, Project administration. Kaimuldinova Kulyash: Conceptualization, Methodology, Resources. Borankulova Dina: Validation, Formal analysis, Visualization.

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