IRSTI 14.25.09 DOI 10.51889/2960-1649.2023.15.3.006

*R.M. MUSSAKHAN [1*], B. AKSOY [2],*

*D.M. BORANKULOVA [1], A.N. BEIKITOVA [1]*

*[1,] Abai Kazakh National Pedagogical University (Almaty, Kazakhstan)*
*[2]Gazi University (Ankara, Turkey)*
*email: musakhan1996r@gmail.com*

# METHODS AND TECHNIQUES OF REMOTE ORGANIZATION OF FIELDWORK IN GEOGRAPHY LESSONS

*Abstract*

Fieldwork is of great importance as a cognitive activity. The article identifies several issues related to the organization of educational fieldwork in general education schools in geography - the inconsistency of educational bases with the forms of educational field practice, and improper performance of educational fieldwork due to the high level of safety rules.

In the course of the research work, an analysis of theoretical and practical scientific works was carried out, and a survey of geography teachers in secondary schools was conducted. By the results of the survey received at the level of the republic, new opportunities for solving the identified issues will be analyzed, and conclusions will be given.

During the analysis, it was suggested that activities at all stages of the organization of hydrological training and fieldwork can be carried out through digital platforms that are conducted remotely. In this regard, the organization of field training in a remote format requires the use of digital resources.

It is clear from the results of the survey that the work of field practice is not always carried out in the traditional format. The methods of organizing hydrological fieldwork at school and the possibilities of using digital tools are determined, and methodological approaches to geography teachers are proposed.

*Keywords:* geographical education; pedagogical technologies; teaching methods; research activities; field practice; digital resources; online whiteboard.

**Introduction.** The standard curriculum of secondary general education in geography in Kazakhstan in textbooks for grades 7, 8, and 9 in the sections "Physical Geography. Hydrosphere" and textbooks of the natural-mathematical direction of the 11th grade in the section "Nature Management and Genecology. Nature management" provides information about the elements of the hydrosphere and hydrological objects.

While the principles of pedagogical activity are reflected in the results of the work, the results of the principles are traced to the meaningful performance of educational fieldwork and the competence of the student. For the fieldwork to be aimed at the cognition of the environment or a certain natural object, the teacher must be competent as a geography teacher. Therefore, the importance of training and fieldwork lies in the content of the tasks performed. In the course of fieldwork when teaching geography, a subject teacher can effectively use techniques and methods that help a student recognize natural objects, develop thinking skills, train research skills, use them in everyday life, help determine intellectual potential, increase interest in conducting scientific research and you can get results.

For the practical integration of theoretical knowledge of students in geography, educational fieldwork is organized. As a rule, field practice is carried out in a traditional format on the school playground using various measuring instruments. The difference between hydrological training and fieldwork from other practices is that the surface of the Earth is carried out near water bodies, which requires a very high responsibility of the geography teacher. This is because the teacher and the school administration are directly responsible for the safety of students' lives. The research paper presents methods and techniques of work and remote execution of

tasks in the course of hydrological field practice, which allows you to consolidate the theoretical knowledge gained by teachers and students in geography, and research competencies.

In geography lessons, with the help of remote technologies, students get acquainted with data on the specifics of the geospatial location of natural water bodies on the surface, hydrological indicators, ways of formation, economic significance, and the current dynamic state (Stagg et al., 2022; Xu & Ouyang 2022; Bianco et al., 2021). To further develop the students' research skills, the teacher needs to offer tasks aimed at developing students' critical thinking skills, the ability to analyze and generalize, evaluate, arousing interest with the help of digital platforms in the educational and methodological direction (Bogiannidis et al., 2023). The combination of theoretical knowledge with practical knowledge allows students to independently conduct research work through fieldwork in the future (Tenison & Sparks 2023).

**Main part.** In geographical education, fieldwork is an activity that occupies an important place, and it is closely related to the result of the rational application of field research methods. The concept of "field work" refers to the local location of the territory or object on which the study is being conducted, that is, to the method, and the experience of the study, but was considered as an object of research. Since the 1980s, the concept of "field work" has been used as a new context (Leininger-Frezal & Sprenger, 2022).

Fieldwork is a special tool that allows students to study geographical information at a high level and develop close relationships between students and teachers. The joint activity of students includes practice-oriented teaching methods in the educational process (Friess et al., 2016).

The use of new pedagogical methods and techniques contributes to the development of students' learning activity, creative and critical thinking, and the improvement of research skills (Muñiz Solari & Schrüfer 2023). Fieldwork plays a key role in geographical education. Fieldwork allows students to learn more deeply the content of the subject geography, the system of research tasks set in the classroom, and correlate the situations of everyday life (Mann & Saultz 2019). In addition, students study ways to solve research problems, communication and research skills, and educational and fieldwork is carried out through a personality-oriented approach (Kim, 2020). The learning process is interactive and practice-oriented, and the main components of geographical education are based on real experience (Wessel 2021). Extracurricular elective courses on field research methods are necessary for students when organizing educational field practice. As a result of these classes, the internal personal qualities of students improve, i.e., observational, organizational, and cognitive abilities (Li et al., 2022).

*Purpose of study.* The article identifies several issues related to the organization of educational fieldwork in general education schools in geography - the inconsistency of educational bases with the forms of educational field practice, and improper performance of educational fieldwork due to the high level of safety rules.

**Materials and methods.** *Data collection tool.* An analysis of theoretical and practical scientific works was carried out, and a survey of geography teachers in secondary schools was conducted.

*Participants.* The survey was attended by geography teachers of the schools of Almaty, Almaty region, Ili district, Uygur district, Talgar district, Kyzylorda region, and geography teachers in Shymkent, Turkestan region and other regions. The number of respondents is 74 (100%). Of these, 86.5% are teachers studying in schools in rural settlements, and 13.5% in urban schools.

*Data analysis.* The results of the survey were analysed quantitatively, using descriptive statistics.

**Results.** *Analysis of theoretical and practical scientific works.* Field training practice contributes to the employment of students in research work. Students use a textbook on the topic of the hydrosphere, additional special literature, necessary information, and Internet sources. Conducts a review of reference data by the object of the study. Practical work keeps records of the actions performed, fully performing tasks by the purpose and task.

Field practice is of great importance as a cognitive activity within the framework of educational goals. In the context of educational activities, it contributes to the knowledge of

nature, geographical objects, and the formation of local historical values, the development of moral qualities. Field practice leads to the development of students' research skills, and research skills further improve the methodology of geographical education (Gordashevskaya, 2013).

Research skills and abilities are the main competencies when performing field practice in geographical education. The components of research skills include systematization of problems, argumentation of hypotheses, fulfillment of research goals and objectives, and analysis of results (Chizhakova & Bocharov, 2019). Educational fieldwork should present the results of the research in a certain form (report, article, wall report, electronic presentation, poster) outlining the algorithm for performing practice-oriented tasks and the results of the work on the result of determining the purpose of the research work of students. The results obtained during the observation and control, measuring work determine the relevance of the field practice of analysis using the scientific method and methods. The main unique natural objects in the implementation of hydrological field practice are surface water bodies. The study of water bodies is carried out after determining the geological structure, relief, and hydrogeological condition of the territory (Maslyayev et al., 2021).

When conducting field practice, school students should have the following competencies: *independent thinking, data processing, analysis of information related to the subject of research, motivation to work, ability to analyze scientific literature, strengthen geographical knowledge, work with modern research instruments, process field laboratory information, organizational qualities, graphic processing, mathematical and statistical calculations, analytical analysis of the object of research, possession of oratorical abilities and critical thinking skills, hydrological assessment of the object* (Pogodina, 2019). In textbooks taught in secondary schools, fieldwork is often expressed in the performance of practical, practical work. But, due to the safety of students' lives, field practice in the curriculum is not performed at its level. There are several reasons for this (not visiting natural objects without parents due to the age restrictions of schoolchildren, strict requirements of safety rules near water bodies, and compliance with safety in case of natural disasters related to the seasons, etc.). Given these compelling reasons, it is possible to organize distance learning and fieldwork, transforming practical and practical work by digital means.

Geographical education occupies a special place in the development of noospheric society. Field practice occupies a special place in the training of geography teachers in higher educational institutions (Artvinli et al., 2022). Research and control work should be comprehensively organized in general education schools. This is evidenced by a survey of geography teachers at the national level, which is conducted in any form.

*Results of survey.* According to the results of the survey, "Do you conduct practical classes by the curriculum?"86.5% answered "yes" to the teacher's question, and 13.5% - "no", that is, they do not carry out saraman work (Figure 1).

According to the instructions of the curriculum, one practical lesson is given in each section. In practical classes, students work with visual aids on a physical map, thematic maps, Internet resources, photographs, electronic resources, etc. Research activities are characterized by tasks aimed at analyzing the object of research. Therefore, practical exercises should be carried out by the plan.

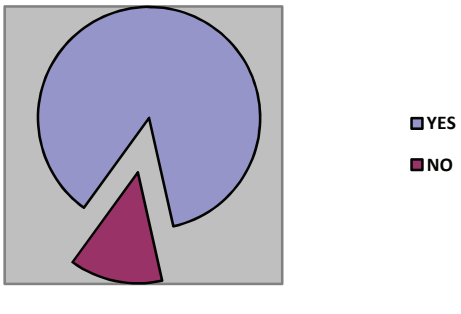


**Figure 1. Survey results on the question *«Do you conduct practical classes by the curriculum?»***

It should be noted that field practice is an activity that occupies an important place in the training of professionals in higher educational institutions, and in secondary schools It is a competence that helps students comprehensively develop field practice that forms research skills. In general, secondary schools, due to the age characteristics of students, it is not allowed to visit natural water bodies without their parents, due to the strict requirements of safety rules near water bodies and safety considerations in case of natural disasters associated with the seasons, etc. field training is not carried out. Therefore, practical tasks by the plan and the requirements of field practice for the curriculum should be performed continuously. In the questionnaire questions, the question is asked about the performance of fieldwork in the classroom or outside of school hours. 74 replies were received (Figure 2).

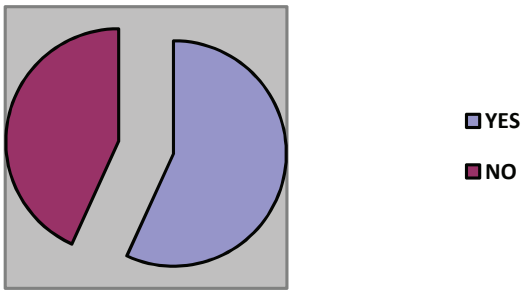


**Figure 2. Survey results on the question**
***«Do you organize fieldwork in the classroom or outside of school hours? »***

56.8% of teachers answered "yes", and 43.2% - "no" to the question about the organization of fieldwork in the classroom or outside of school hours. The development of students' knowledge and skills based on research skills in teaching, and orientation to independent problem solving contributes to the achievement of the goals of field practice by students.

**Discussion.** To the question of what methods and techniques are used in the organization of educational field work, teachers recorded their opinions in the survey. In the feedback received, teachers met such answers as "*non-allocation of special hours for field work, inconsistency of educational bases with the forms of field practice* and in others - *"organization of a special one-day hike, conducting fieldwork with students, orientation work"*. By the results of the survey, the following issues can be identified: *insufficient performance of tasks and methodological assistance that helps in improving research skills; improper performance of educational fieldwork due to the high level of safety rules.*

To solve these issues, the theoretical information obtained can be carried out through practical management, control, and study using the help of digital platforms. In this regard, since field practice is not often implemented in general secondary schools, the following types of work can be included in the chain of practical, research, and practical tasks. At the initial preparatory stage of practical work *Airpano.ru, you can use a virtual tour project*. This program is a photo project consisting of a collection of professional high-quality panoramic photos and videos. Helps in the implementation of field training practice in the online orientation of the source object, supplementing the received theoretical information with visual aids. During a virtual journey through this photo project, morphometric indicators of the relief and other water sources allow you to track the location features and the impact of River-lake objects on everyday life and navigate in the direction of 360º. The figures below clearly show the work on the orientation of a hydrological object at a high-quality level (Figure 3). First of all, to create a tour project, you need to connect a personal computer or laptop to the Internet. The photo project can be used for free, but it is paid due to some levels of digital data. Using it as a theoretical source of information when performing orientation work is very effective.

In the course of this task, variants of traditional and remote methods of field training were given. In both variants, tasks were given that, according

to the work plan, will allow students to fully achieve the goal of field practice (Mussakhan & Borankulova, 2022). The research work established that the proposed approaches will be implemented during the preparatory and fieldwork when studying the sources of water bodies of the photo project. In this regard, the orientation of geographically different objects can be offered in daily geography lessons as an auxiliary electronic methodological resource.

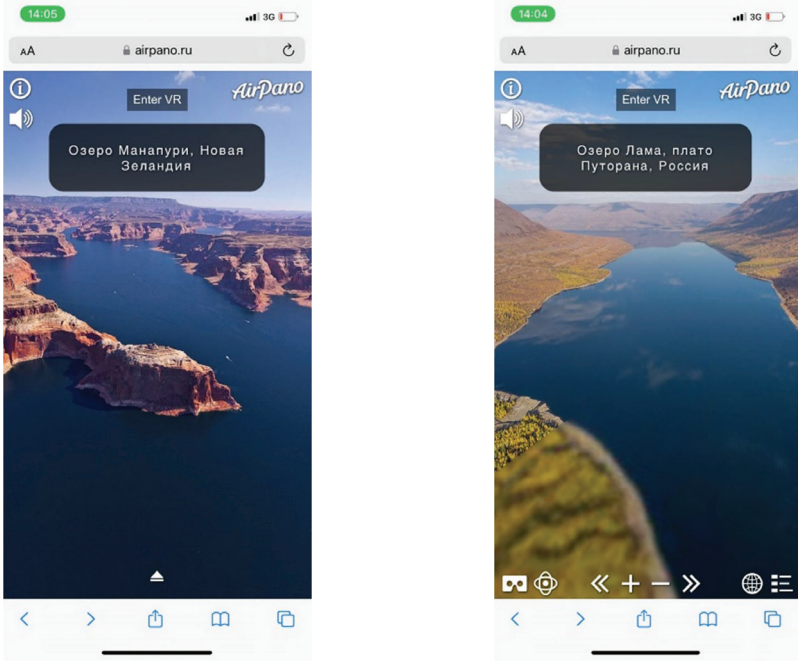


**Figure 3. Hydro-orientation in the Airpano virtual tour project**

When orienting photo projects, it is advantageous to use the "smartphone" tool. First of all, the internet and the internet source must be browsers. You can log into the photo project by writing the name of the photo project in the browser. You are writing the desired object for the search sign, or there are already ready-made objects in the templates. In the images above, you can take a fresh look at the 360º virtual tour by pressing the "Enter VR" button. You can conduct orientation work as if admiring a real object. During operation, the button at the top of the "sound" button allows you to view the object live by pressing the "globe" button to see the position of the object on the world map, the "+/-" buttons to zoom in or move the object, the button at the top of the "sound" button provides information about the object. An electronic auxiliary resource for use when familiarizing with objects using identified elements, fixing, mastering a new lesson, and strengthening theoretical knowledge during training and fieldwork. At the next stage of the practical lesson, after work and familiarization with theoretical information, to control the main water bodies. That is, on the presented online board "Classroomscreen", students will be able to present practical work to group members. This visual online whiteboard was invented by a Dutch teacher. The teacher has created an online whiteboard that combines and uses for free all the important elements that are convenient for him (timer, image loading, infographics, drawing mode, background insertion or structured drawing related to the lesson, language selection, etc.). The online board "Classroomscreen", consisting of many features, contributes to the visual, understandable provision of information obtained during the successful conduct of practical classes. During the control work with the online whiteboard, many advantages were revealed (Figure 4). Students in the first part of the practical lesson Airpano.ru in the virtual tour project, focused on the necessary form and collecting theoretical information, on the online blackboard "Classroomscreen", performing actions defined for the lesson, the class can offer students work in the last reporting part of the lesson, as infield practice.

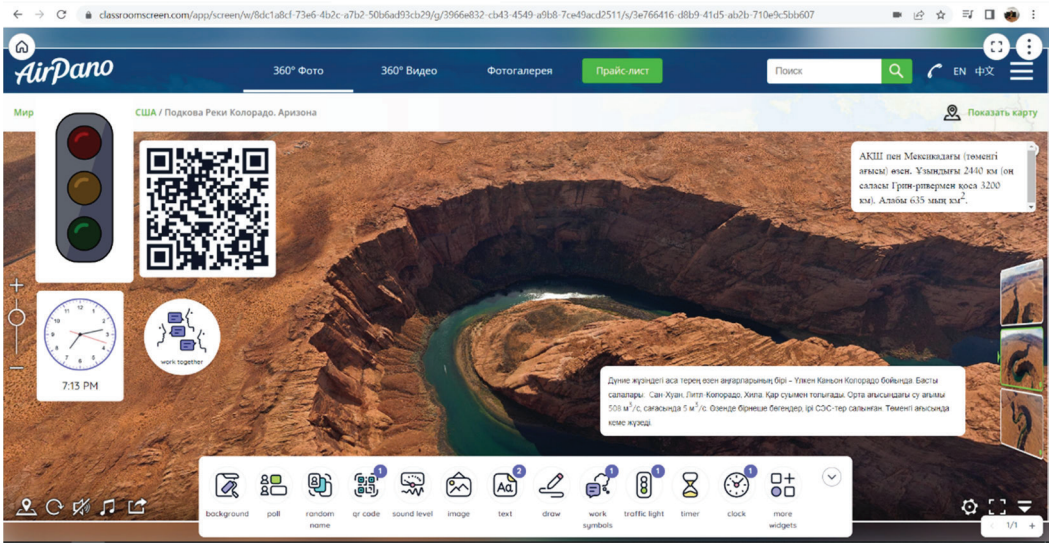


**Figure 4. Work on river analysis on the online board "Classroomscreen"**

By logging into the online board "Classroomscreen", and clicking on the "background" button, the object of research is entered against the background, information about the object being studied during the practical lesson and the analyses revealed during the study can be added to the image of the object. You can use the "Traffic light" button as a means of communication with other people. Red - there is a question or need help, yellow - indicates the progress of the work, and indicates the result of the work. The "Clock" button helps to keep track of the lesson time or time limit when presenting an object being studied between groups. The "Qr-code" button shows the address of a link to other additional information or sources from which it was obtained. In the presented research paper Airpano.ru there is a link with additional video information about the Colorado River in the virtual tour project. The "discussion" button is included on the panel page in the proposed research paper to attract the attention of students and recall the purpose of the lesson. Figure 4 shows the result of the work carried out in the reporting part of the practical work. Using it as a visual aid in geography lessons and other subjects studied not only increases students' interest in the lesson but also is a methodological auxiliary application for teachers, a resource for finding students, as well as an important method in achieving educational goals in the classroom. A student doing research work "Airpano.ru "after watching additional video information and video data about the Colorado River in the virtual tour project in a live format, the information received and the teacher, performing tasks with orientation, individually or in groups, penetrate the online board "Classroomscreen", analyze opinions, conclusions about the collected data and record it on the online board. After submitting a research paper as feedback, you can ask for help from the online board "Padlet". The Padlet online whiteboard is an online whiteboard with stickers that can be used in all subjects while working collectively using a computer and smartphone. Features of the online whiteboard "Padlet": The teacher can give students a task during the lesson with a link; with the free version, you can use three different windows; includes many designs; *Using eight different templates (brick, any shape, ribbon, sequence, grouping, chat, map usage, chronology), he can help in using brainstorming functions and methods, questions and answers, as well as feedback, which he uses by the topic of the lesson and the purpose of the training.* The effectiveness of this online whiteboard in the performance of feedback work was demonstrated in the remote performance of training and fieldwork (Fig.5).

The online board "Padlet" was used to establish feedback when determining the effectiveness of field training during remote passage. That is, the teacher passes the link to the students through the means of communication, and the students open the received link and

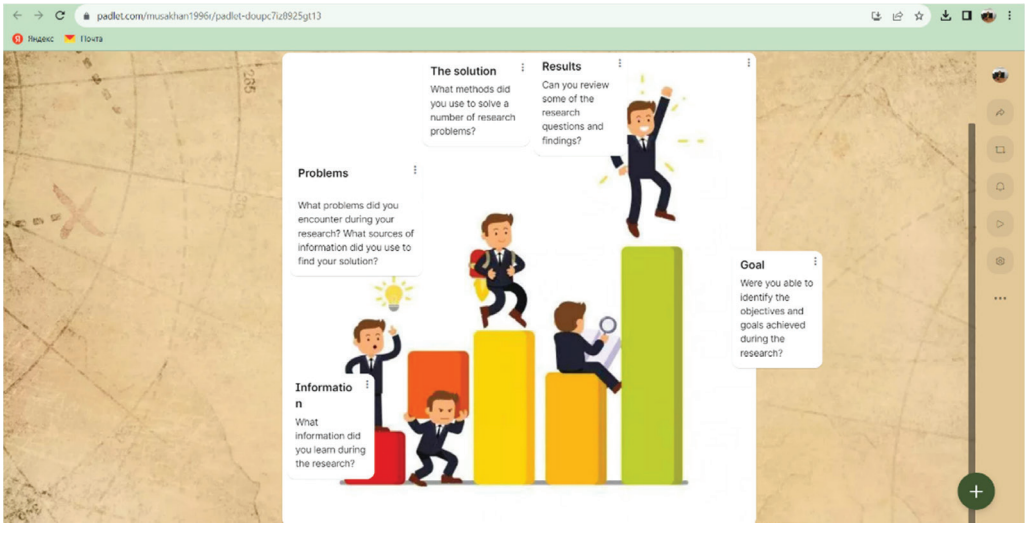


**Figure 5. Feedback on the online board "Padlet"**

answer feedback questions by the results of the work performed during the study. In this author's research paper, students answer by choosing an information ladder, during the research they can only analyze the information and determine whether they are familiar. If a ladder of problems is selected, it analyzes the information during the research, shows the level of problem-solving, and chooses a ladder of solutions–it can analyze information, identify problems, and propose solutions. Students who have fully completed the research work can easily respond to the results and goals of feedback because the information is analyzed, problems are identified, answers to solutions are found, results are found, and they prove that a student can not only fully achieve the lesson goal, but also independently perform field work remotely, having a direct impact on the development of students' research skills.

Currently, it is known that the use of teaching methods on topics about the Earth, climate, nature, and the environment with the involvement of goals and objectives to increase the interest of students is carried out directly using digital tools. In the perception of information, students cannot fully assimilate what they have heard, they perceive information visually (Akisheva & Borankulova, 2022). In addition, conclusions about the importance of digital tools are becoming increasingly relevant in studies of the updated content of education. Education is not only the teaching or interpretation of accumulated knowledge, but also the teacher's ability to master, apply, and direct pedagogical and digital technologies, adapt to new social changes, manage emotions, and be able to work with an information resource (Kusherbayeva & Orakova, 2021). When implementing the recommendations and conclusions in the study, students:

- can set goals and objectives when performing search and analytical work when solving any tasks;
- In the process of achieving the results of the study, hydrological objects can be considered by students in various ways;
- analyzes the results of the conducted research;
- it is organized in studies conducted separately from individual couples, and groups during the work being carried out;
- Respecting the opinions of other students, they will adapt to the new environment and develop the values of responsibility (Abdikarimova et al., 2021).

The main thing is not to use information and communication tools only in your interests, but to combine them with the educational process and form research skills during training.

Digitalization of education is an activity consisting of digital competencies, which is inevitably necessary in teaching, and requires new changes in the role and activity of the teacher (Stukalenko et al., 2021 p. 85). Formulated the concept of digital educational resources (DER) as an effective tool in modern research and

determined that their widespread use contributes to the simplification and improvement of education (Sardarova et al., 2022). Control activities in pedagogical education, and conducting research work are significantly different from paperwork and writing in the classroom. There are two different problems: limiting activity within the class and limiting the use of technical means. But, without remaining in a limited space, you can accept the concept of a "window for practice", gain experience and observe a known observer object. The possibilities and greater accessibility of video viewing with the help of 360-degree VR headsets can expand the database of information when oriented in any space. It has been found that using conventional images for classroom control work helps teachers to conduct reflection and analysis, obtain evidence of improved experience to increase confidence and emotional readiness, observe alternative teaching methods, challenge pedagogical forecasts and problems, and link learning theory with practice. Video tutorials attract teachers looking for authenticity (Cross et al., 2022)

**Conclusion**. New ideas and digital tools are of great importance in improving students' cognitive activity, research skills, and the effectiveness and quality of the educational process. Significant changes in society not only affect the education system but also cause requests to improve the efficiency of the learning process.

It is established that the organization of educational and fieldwork, depending on the results of the survey, is carried out infrequently. The researchers suggested that its solution could be carried out using remote approaches – digital tools. Based on the above, digital learning is a pedagogical system characterized by functionally developing activities with new, continuous structural features. This happens not only through the discovery of ways of development in the fields of theory and methodology of lifelong learning but also through the methods of rational learning with the help of new technologies.

Modern learning is a set of methods that focus on teaching students and improving their game, and behavior with the help of various new ideas in the curriculum. Teaching with the help of digital tools is directly related to the scientific and methodological activities of teachers and the research ability of students. When studying each discipline, depending on the purpose of the lesson, classes, and field practice conducted using digital platforms, online whiteboards are rationally conducted.

When a student works on solving a problem, planning and checking solutions are his main activities. In the process of solving research tasks, the student observes and analyzes information about the object of research. That is why the student's personality and abilities are developed through research skills. This may affect the quality of full participation and familiarization of the student with the object of study, the use of research, and research activities. In addition to learning, gaining knowledge, and vocational training, students also study moral and spiritual values. Digital educational resources provide students with ample opportunities for remote organization of field practice.

*References*

Abdikarimova G., Kabulova ZH., Tleubergenova K. (2021). Vozmozhnosti ispol'zovaniya interaktivnoy metodologii v prepodavanii geografii. Pedagogika i psikhologiya, 3(48), 150–160. DOI: 10.51889/2021-3.2077-6861.17 https://journal-pedpsy.kaznpu.kz/index.php/ped/article/view/257

Akisheva M., Borankulova D. (2022). Preimushchestva organizatsii urokov geografii s ispol'zovaniyem videomaterialov. Pedagogika i psikhologiya, 3(52), 216–224: DOI: 10.51889/81.71.2022.12.87.023 https://journal-pedpsy.kaznpu.kz/index.php/ped/article/view/825

Artvinli, E., Gryl, I., Lee, J., & Mitchell, J. T. (Eds.). (2022). Geography Teacher Education and Professionalization. Springer. https://link.springer.com/book/10.1007/978-3-031-04891-3?fbclid=IwAR3a_JxlUCvIsasMS2AV78on43qcPA5Z8avix3Pt9JAHHMWuRkemGt-frec

Bianco, N. D., Giaconi, C., Gison, G., D'Angelo, I., & Capellini, S. A. (2021). Inclusion at the University through Technology: A case study in Italy. International Journal of Special Education and Information Technologies, 7(1), 01–15. https://doi.org/10.18844/jeset.v7i1.6793

Bogiannidis, N., Southcott, J. & Gindidis, M. (2023). An exploration of the possible educational opportunities and the challenges at the intersection of the physical and digital worlds occupied by 10–14-year-old students. Smart Learn. Environ. 10, 26. https://doi.org/10.1186/s40561-023-00246-w

Chizhakova G.I., Bocharov A.V. (2019). Formirovaniye issledovatel'skoy kompetentsii studentov v protsesse polevoy praktik. Problemy sovremennogo pedagogicheskogo obrazovaniya, 63(2), 245. https://cyberleninka.ru/article/n/formirovanie-issledovatelskoy-kompetentsii-studentov-v-protsesse-polevoy-praktiki/viewer

Cross S., Wolfenden F., Adinolfi L. (2022). Taking in the complete picture: Framing the use of 360-degree video for teacher education practice and research. Teaching and Teacher Education, 111. DOI: https://doi.org/10.1016/j.tate.2021.103597

Friess, D. A., Oliver, G. J., Quak, M. S., & Lau, A. Y. (2016). Incorporating "virtual" and "real world" field trips into introductory geography modules. Journal of Geography in Higher Education, 40(4), 546-564. https://www.tandfonline.com/doi/abs/10.1080/03098265.2016.1174818

Gordashevskaya A.I. (2013). Uchebno-polevaya praktika v sisteme podgotovki budushchego uchitelya geografii. Vestnik Akademii znaniy, 1(4), 3-5. https://cyberleninka.ru/article/n/uchebno-polevaya-praktika-v-sisteme-podgotovki-buduschego-uchitelya-geografii

Kim M. (2020). Developing pre-service teachers' fieldwork pedagogical and content knowledge through designing enquiry-based fieldwork. Journal of Geography in Higher Education, 46, 61-79, https://doi.org/10.1080/03098265.2020.1849065

Kusherbayeva M., Orakova A. (2021). Ob osobennostyakh obnovlennoy sistemy obrazovaniya. Pedagogika i psikhologiya, 3(48), 253–264: DOI: 10.51889/2021-3.2077-6861.28, https://journal-pedpsy.kaznpu.kz/index.php/ped/article/view/232

Leininger-Frezal C., Sprenger S. (2022). Virtual field trips in binational collaborative teacher training: Opportunities and challenges in the context of education for sustainable development. Sustainability, 14(19), 12933. https://www.mdpi.com/2071-1050/14/19/12933

Li Y., Krause S., McLendon A. & Jo I. (2022). Teaching a geography field methods course amid the COVID-19 pandemic: reflections and lessons learned. Journal of Geography in Higher Education. https://doi.org/10.1080/03098265.2022.2041571

Mann, B., & Saultz, A. (2019). The Role of Place, Geography, and Geographic Information Systems in Educational Research. AERA Open, 5(3). https://doi.org/10.1177/2332858419869340

Maslyayev V.N., Zhuravleva A.D., Yegorova K.D. (2021). Issledovaniye rodnikov vo vremya polevoy geoekologicheskoy praktiki: Nauchnoye obozreniye. Mezhdunarodnyy nauchno-prakticheskiy zhurnal, 4, 1-11. https://cyberleninka.ru/article/n/issledovanie-rodnikov-vo-vremya-polevoy-geoekologicheskoy-praktiki/viewer

Muñiz Solari, O., & Schrüfer, G. (2023). Understanding Sustainability with Pedagogical Practice: A Contribution from Geography Education. https://eref.uni-bayreuth.de/id/eprint/86560/

Mussakhan R.M., Borankulova D.M. (2022). Qaşıqtıqtan oqıtu jağdayında oqu-dala jumıstarın uyımdastıru mümkindikteri. "Turaqtı damu maqsattarı ayasında jaratılıstanu ğılımdarı men biliminiñ damu mäseleleri" attı xalıqaralıq ğılımi-praktikalıq konferenciya materialdarı, 213-217.

Pogodina V.L. (2009). Formirovaniye professional'no znachimykh kompetentsiy bakalavrov i magistrov obrazovaniya geograficheskogo profilya na polevykh praktikakh. Izvestiya Rossiyskogo gosudarstvennogo universiteta im. A.I.Gertsena, 109, 43-57. https://cyberleninka.ru/article/n/formirovanie-professionalno-znachimyh-kompetentsiy-bakalavrov-i-magistrov-obrazovaniya-geograficheskogo-profilya-na-polevyh/viewer

Sardarova ZH. I., Kismetova G. N., Turezhanova G. A., Sarkulova D. S. (2022). Formirovaniye gotovnosti budushchikh pedagogov k ispol'zovaniyu tsifrovykh obrazovatel'nykh resursov v usloviyakh tsifrovizatsii obrazovaniya. Vestnik KazNU. Seriya pedagogicheskaya, 1(70), 47-57: https://bulletin-pedagogic-sc.kaznu.kz/index.php/1-ped/article/view/1218

Stagg, B.C., Dillon, J. & Maddison, J. (2022). Expanding the field: using digital to diversify learning in outdoor science. Discip Interdscip Sci Educ Res 4, 9. https://doi.org/10.1186/s43031-022-00047-0

Stukalenko N., Imanova A., Mukanova R. (2021). Professional'noye razvitiye pedagogov v usloviyakh tsifrovizatsii obrazovaniya. Pedagogika i psikhologiya, 1(46), 79–85. https://journal-pedpsy.kaznpu.kz/index.php/ped/article/view/175

Tenison, C., & Sparks, J.R. (2023). Combining cognitive theory and data driven approaches to examine students' search behaviors in simulated digital environments. Large-scale Assess Educ 11, 28. https://doi.org/10.1186/s40536-023-00164-w

Wessell, J. E. (Ed.). (2021). Experiential Learning in Geography: Experience, Evaluation and Encounters. Springer Nature. https://books.google.com/books?hl=en&lr=&id=APFLEAAAQBAJ&oi=fnd&pg=PR5&dq=Experiential+Learning+in+Geography+Experience,+Evaluation+and+Encounters,+Jonathan+E.+Wessell&ots=oLW0-QwZl4&sig=kDfllWxwBmQxAH2BVpDmibC_Bis

Xu, W., Ouyang, F. (2022). The application of AI technologies in STEM education: a systematic review from 2011 to 2021. IJ STEM Ed 9, 59. https://doi.org/10.1186/s40594-022-00377-5