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INNOVATIVE PEDAGOGICAL TECHNOLOGIES APPLIED IN THE RESEARCH PROCESS

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Abstract. This article examines the innovative pedagogical technologies applied in the research process aimed at improving students' educational and cognitive activity. It highlights the role of interactive, problem-based, project-based, digital, STEM/STEAM, and inquiry-based learning approaches in modern education. The study analyzes how these technologies contribute to developing students' independent thinking, critical analysis, creativity, and research skills. Special attention is given to the effectiveness of these methods in geography education, where they enhance understanding of complex spatial and environmental processes. The findings indicate that the systematic use of innovative pedagogical technologies significantly improves the quality of learning outcomes and promotes a student-centered educational environment.

Key words: innovative pedagogical technologies, research process, interactive learning, problem-based learning, project-based learning, digital education, STEM/STEAM approach, inquiry-based learning, cognitive activity, geography education.

Introduction. In conducting the research, special attention was paid to the methodological organization of the experimental work and the proper selection of methods that ensure effectiveness and reliable results. As it is stated, "research methods are selected based on the topic, problem, hypothesis, purpose, and objectives of the study". Therefore, the selection of appropriate methods requires awareness of specific criteria, which play an important role in ensuring scientific validity. In this regard, the following criteria were used in selecting research methods:

– ensuring objective evaluation of the object, process, or situation;

– accuracy (taking into account the specific features and conditions that determine the existence of the object or process under study);

– comprehensive consideration (examining the object, process, or situation in all its interrelations and connections);

– historicity (considering the object, process, or situation from a developmental perspective, taking into account its changes, stages, and evolution over time).

Considering the content, nature, and educational characteristics of the scientific-pedagogical research aimed at improving students' educational and cognitive activity through developmental technologies in geography lessons for 7th–8th grade students in general secondary schools, the following scientific-pedagogical methods were identified as effective in ensuring the efficiency of the process:

1. Questionnaire Method. The term "questionnaire" (French enquête, English inquiry – investigation, survey, data collection) refers to a methodological tool used to obtain initial social and socio-pedagogical information through oral or written surveys. A questionnaire usually consists of a set of structured questions designed to achieve a specific objective, and the answers are used to draw pedagogical conclusions. The preparation of a questionnaire is a complex process, as the reliability of research results depends on the content of the questions, their structure, and the number of respondents. In this study, the questionnaire developed by the researcher helped to assess 7th–8th grade students' attitudes toward geography, their interest, and their level of educational and cognitive activity.

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Two versions of the questionnaire were prepared: one for students and another for geography teachers involved in the experimental process. The questionnaire included a total of 10 questions. Based on the responses, motivational components reflecting students' cognitive activity in geography education were analyzed. The changes recorded during the pre- and post-experimental stages were analyzed statistically.

2. Interview Method. The interview method is used to enrich data obtained through pedagogical observation, assess situations correctly, and identify pedagogical conditions that contribute to solving research problems. Interviews may be conducted individually, in groups, or on a mass scale and represent a dialogic teaching method based on questions and answers. In this research, interviews were conducted in a structured and purposeful question–answer format between the researcher and students or teachers. The interviews aimed to identify students' attitudes toward geography, internal motivational factors (interest, need, motivation), their ability to use developmental technologies, and their level of participation in lessons. They also helped identify difficulties and problems in learning geography.

The interview method complements and clarifies questionnaire and test results. It also helps to study students' subjective learning experiences and improves the pedagogical model and methodological system used in the experimental process. In addition, it increases the reliability and objectivity of the research results.

3. Test Method. The term "test" (English: test – to examine, to check) refers to a short standardized assessment method used to determine students' intellectual development, abilities, skills, personal characteristics, and level of knowledge and competencies. The main feature of this method is measuring students' knowledge, skills, and cognitive activity through standardized questions and tasks. In geography lessons for 7th–8th grade students, tests are used to activate learning processes, assess knowledge, encourage independent thinking, and ensure objective evaluation of learning outcomes. At the same time, in the context of developmental technologies, tests also serve as a didactic tool that promotes analysis, critical thinking, and conclusion-making skills.

The test method used in this experimental study helped compare quantitative and qualitative results between experimental and control groups, ensure objectivity and reliability of results, and analyze the dynamics of changes before and after the experiment.

4. Interview Method. The term "interview" originates from English and means "conversation." At first glance, the interview and conversation methods may seem similar, but in fact, they differ in several important aspects. Researchers such as V.V.Voroshilov emphasize that unlike ordinary conversation, interviews are characterized by short, precise, and structured questions, while also allowing respondents to express their views in detail in the interest of society.

S.N.Ilchenko defines the interview as a structured interaction between a researcher (teacher, journalist, etc.) and a respondent aimed at obtaining relevant information through systematically organized questions and answers.

Table 1

Differences between Conversation and Interview Methods

T/R	Comparison Criteria	Conversation Method	Interview Method
1	Purpose	To freely study students' or teachers' opinions, attitudes, and impressions	To collect specific information on a predefined problem
2	Structure	Free or semi-structured	Mostly structured or strictly planned
3	Form of questions	Open and flexible; may change during interaction	Pre-prepared and delivered in a fixed order

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4	Participants	Mainly conducted with students	Mostly conducted between teachers and methodologists
5	Nature of communication	Friendly, informal, and trust-based	Relatively formal and research-oriented
6	Type of data	In-depth qualitative data	Systematic and comparable data
7	Stage of application	Mainly diagnostic and formative stages	Mainly formative and control stages
8	Data processing	Content analysis	Categorization, tabulation, comparative analysis

In terms of content, the use of the interview method in geography education serves to identify the practice of applying developmental technologies in teaching, their effectiveness, organizational and pedagogical conditions, and existing problems. It is also used to study teachers' experience in using developmental technologies, to identify factors hindering the improvement of students' cognitive activity in geography lessons, and to refine the pedagogical model and methodological system developed by the researcher aimed at increasing the cognitive activity of 7th–8th grade students through developmental technologies.

5. Pedagogical Observation Method. Pedagogical observation is defined as a research method aimed at systematically and purposefully recording changes in students' activities, behavior, and cognitive processes in natural conditions during the educational process. It is used to determine the current state of the researched problem based on the study of teaching and learning processes in educational institutions. According to observation results, differences between initial and final experimental indicators are analyzed. The researcher is provided with concrete factual data and information.

In scientific-pedagogical research, observation can also be used as a source of data for hypothesis development, or for verifying data obtained through other methods, as well as for collecting additional information about the research object. In geography lessons for 7th–8th grade students, pedagogical observation is used to study students' interest in geographical knowledge, motivation, emotional attitude, and active participation in lessons; their ability to ask and answer questions; their collaboration skills in group and pair work; and their independent approach to solving problem-based tasks.

During the experimental work, the observation process was organized in a purposeful, consistent, and continuous manner, which ensured its effectiveness. As a result, the real level of students' cognitive activity was identified; qualitative changes caused by developmental technologies were observed; the dynamics of motivational, cognitive, and activity-based components were determined; and data obtained through questionnaires, tests, and interviews were clarified. It also helped to substantiate pedagogical decisions made during the experimental stages. Typically, in scientific-pedagogical research, observation is conducted in open or hidden forms, continuously or periodically, and often using specially prepared observation sheets (checklists). All of these forms were appropriately applied in this research.

6. Modeling Method. The term "modeling" (French modèle, Latin modulus – measure, standard) refers to a scientific research method based on the use of a model that replaces reality and is usually represented in schematic form. In other words, modeling reflects the studied real pedagogical process in a simplified, systematized, and theoretically generalized form, enabling the study of the object not directly, but through its model.

Pedagogical modeling is a type of professional pedagogical activity in which a teacher creates a structured model of a phenomenon, process, mechanism, condition, problem, resource, pedagogical tool, method, organizational form, or causal relationship. This model provides opportunities for studying, measuring, analyzing, classifying, systematizing, and adapting

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educational materials or systems within a defined pedagogical framework. Functionally, pedagogical modeling allows the design of perspectives, goals, and means for the development and transformation of pedagogical processes in educational activity. Today, teaching new educational material without diagrams, techniques, formulas, and models is considered less effective. Therefore, in recent decades, special attention has been paid to developing pedagogical models that clearly describe methodological systems and pedagogical conditions for educational practice.

In this research, the modeling method was used to scientifically design a pedagogical system aimed at improving students' cognitive activity in geography lessons. It allowed the systematic identification of the structure, components, interrelationships, and mechanisms of the process, as well as the organization of experimental work in a methodologically sound manner. The modeling method also helped define the stages of introducing developmental technologies, the interaction between the researcher (teacher) and students, organizational and pedagogical conditions, expected results, and evaluation criteria.

In this study, the model of improving students' cognitive activity consists of the following structural blocks:

- target-conceptual block
- content-methodological block
- organizational-activity block
- control-evaluation block
- result-reflective block

These blocks ensure a systematic, logical, and consistent organization of the research process. Didactic importance of the modeling method in geography education the modeling method has significant didactic advantages in geography education, particularly when using developmental technologies. These include:

Systematization of the learning process, where the relationship between lesson objectives, content, methods, tools, and outcomes becomes clear, enabling effective lesson planning and organization.

Activation of students' cognitive activity, as models include problem-based tasks, diagrams, maps, tables, and graphical structures that develop analysis, comparison, generalization, and conclusion-making skills.

Facilitation of understanding abstract concepts, as complex geographical processes (climate change, atmospheric circulation, tectonic movements, etc.) are explained visually and logically.

Prediction of educational outcomes, enabling improvement in cognitive activity, independent thinking, and interest in geography.

Targeted implementation of innovative technologies, ensuring that developmental technologies are applied purposefully at appropriate stages of the lesson.

7. Expert Evaluation Method. In pedagogical activity, expert evaluation refers to qualitative or quantitative assessment of an object by highly qualified specialists to support decision-making. It includes expert opinions based on comparing objects and their characteristics according to defined criteria. When expert opinions are consistent or closely aligned, the average or modal value of expert judgments is considered reliable.

Expert evaluation is aimed at determining the applicability, practicality, and effectiveness of innovative pedagogical models or methods introduced into the educational system. It involves studying the opinions of experienced specialists regarding whether the proposed pedagogical model meets existing needs and ensures teaching quality and effectiveness.

One of the key features of expert evaluation is its probabilistic nature, as it relies on specialists' ability to provide useful information under uncertainty. When obtained from a group of experts, the aggregated opinion is considered reliable. Moreover, expert evaluation is oriented

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toward forming a basis for prospective intellectual development, rather than merely comparing individual capabilities.

The use of the expert evaluation method in the research aimed at improving 7th-8th grade students' cognitive activity in geography lessons through developmental technologies refers to a process in which highly qualified specialists working in the field of education-geography teachers, methodologists, pedagogical researchers, and education quality assessment experts-provide well-grounded conclusions based on predetermined criteria regarding the pedagogical model and methodological system proposed for school practice.

During the research process, an expert group was formed, consisting of Professor of Namangan State University, Doctor of Geographical Sciences K.M. Boymirzayev, Doctor of Philosophy (PhD) in Pedagogical Sciences, Associate Professor B.M. Abdurakhmanov, and experienced geography teachers A.M. Toshpo'latov and H.N. Naimov. This expert group provided conclusions regarding the practical value of the pedagogical model and methodological system intended for school implementation.

The organization of this process was carried out in the following stages:

Selection of experts: Five experienced geography teachers and methodologists from the higher education institution and experimental schools were involved.

Determination of evaluation criteria: Based on the content of the research, curriculum, and methodological system, the following criteria were defined:

- integrity of the pedagogical model;
- applicability of the methodological system in practice;
- effectiveness of developmental technologies in teaching geography;
- impact of innovative pedagogical technologies on students' cognitive activity;
- observed dynamic improvement in learning outcomes.

Selection of assessment tools: Questionnaires, rating scales, expert evaluation sheets, and structured forms with open and closed questions were used.

Analysis of results: The average scores given by experts, the degree of agreement among evaluations, and suggestions for improving geography teaching were analyzed and summarized.

Based on expert feedback, lesson plans, innovative interactive methods, problem-based, project-based, and game-based learning tasks, as well as diagnostic and assessment criteria for students' cognitive activity, were revised and improved.

From a scientific-pedagogical perspective, the expert evaluation method in this study served the following purposes:

- verifying the scientific validity of the research concept;
- determining the compatibility of selected developmental technologies with geography content;
- identifying factors that enhance students' cognitive activity;
- ensuring the objectivity of experimental results;
- improving methodological recommendations.

8. Pedagogical Experiment Method. The pedagogical experiment, in terms of its content and scientific nature, is defined as a scientifically grounded experiment aimed at modifying the pedagogical process under controlled conditions (I.P. Podlasy), or as the active intervention of a researcher into a pedagogical phenomenon to discover laws and improve existing practice (Yu.Z. Kushner).

A properly organized pedagogical experiment not only establishes correlations between variables but also allows verification of cause-and-effect relationships. Through experimental research, the validity of the proposed hypothesis, its applicability in practice, and its methodological value are tested. Conducting a pedagogical experiment is more complex than describing theoretical aspects, as its proper organization ensures research success. Moreover, a correctly organized experiment helps to efficiently manage the activities of both the researcher

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and participants without negatively affecting their main responsibilities and allows effective use of time.

In this research, the main purpose of applying the pedagogical experiment method was to test in practice the effectiveness of the pedagogical model and methodological system aimed at increasing students' cognitive activity in geography lessons through the systematic use of developmental technologies, and to scientifically validate its effectiveness.

The method also served the following specific purposes:

– testing the validity of the scientific hypothesis;
– implementing pedagogical innovations in real educational conditions;
– identifying qualitative and quantitative changes in students' cognitive activity;
– drawing scientifically grounded conclusions for improving the educational process.

9. Mathematical-Statistical Analysis Method. The mathematical-statistical analysis method is defined as a technique used to systematically study, summarize, and evaluate the reliability of experimental results in pedagogical research.

The main purpose of using this method in scientific-pedagogical studies is to determine the effectiveness of experimental work. According to this approach, data obtained from experimental and control groups at the beginning and end of the study are analyzed using mathematical formulas, and the final values represent the main indicators of research effectiveness.

Statistical methods used in research include:

– statistical observation;
– data collection and grouping;
– absolute and relative statistical values;
– variation series;
– sampling methods;
– correlation and regression analysis;
– time series analysis.

In this study, the mathematical-statistical method was used to process data obtained from pedagogical observation, testing, and experimental results. Its purpose was to analyze and objectively evaluate the impact of developmental technologies on students' cognitive activity in geography lessons.

The method helped to:

– ensure reliability of research results;
– quantitatively measure students' cognitive activity (participation, independent work, analytical skills, knowledge level, etc.);
– compare experimental and control group results;
– statistically verify the research hypothesis;
– replace subjective conclusions with objective numerical data;
– compare results before and after the experiment;
– calculate averages, percentages, variance, and standard deviation;
– confirm the validity of findings;
– integrate data from tests, expert evaluations, and observations.

Thus, the combined use of scientific-pedagogical methods provided a solid methodological foundation for analyzing the effectiveness of developmental technologies in geography education and substantiating the research results.

Conclusion. Scientific-pedagogical methods play a crucial role in organizing the educational process on a scientific basis, studying students' cognitive activity, and determining educational effectiveness. Practical experience has shown that the purposeful use of these methods in experimental research is essential. During the experiment, these methods helped to determine students' cognitive activity levels, monitor their dynamics, and evaluate the effectiveness of developmental technologies in geography education.

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