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Teachers' competencies in organizing educational research activities and their impact on the development of students' scientific thinking

The article investigates the impact of teachers' competencies in organizing educational and research activities on the development of students' scientific reasoning and cognitive and analytical skills. Insufficiently developed mechanisms linking teachers' professional competencies with students' research ability formation create the research problem. The study aims to identify the key factors and mechanisms through which teachers' professional competencies in planning and implementing educational and research activities contributes to students' scientific development. Literature analysis, observation, surveys, testing, and modeling were employed as research methods. The findings of the experiment support the research hypothesis, demonstrating a significant relationship between development of the teacher's research competencies and the enhanced students outcomes in the experimental group, including cognitive activity, learning motivation, and overall engagement in the educational process. A model for enhancing teachers' competencies was developed. The scientific novelty of the study consists in the application of a comprehensive approach to examining the process of developing competencies related to the organizing of research activities among elementary school teachers. The practical significance of the study lies in the potential application of the proposed model and the obtained findings in the pedagogical practice. Specifically, the result may be used to enhance university-level teacher education programs, to design targeted professional development courses, and to implement effective psychological and pedagogical technologies aimed at increasing students' cognitive activity and learning motivation in classroom settings.

Keywords: teacher competencies, schoolchildren, thinking, education in modern conditions, organization of activities, scientific thinking, educational technologies, academic skills.

Introduction

Education in modern conditions constantly poses new challenges to schools and teachers, among which the problem of formation of scientific thinking in schoolchildren is especially significant. To solve this problem, it is usually suggested to organize more effective educational research activities. Such problems are also noted in Kazakhstan (Agayeva S.A., 2020; Beisenbayeva A., 2020), in the conditions of modernization and renewal of the content of the entire education system and accelerated technological progress, which lead to rapid growth of knowledge at all levels (from preschool to postgraduate) [1; 2]. In such conditions, it is important to develop in students the ability to think critically, to analyze educational information, and in particular to conduct independent research in the learning process. This is due to the fact that such skills play a key role, as they become the basis for successful adaptation in the modern world, where innovative thinking and the ability to solve non-standard problems are important.

The need to modernize the educational process in schools primarily determines the relevance of studying teachers' competencies in organizing students' educational research activities. Modern schools must prepare students beyond factual academic knowledge. It is necessary to teach them to carry out independent work, both to search for necessary information and to find ways of solving complex problems, using scientific methods of cognition of the world, within the studied subjects and life in general. In order to solve such problems, teachers themselves need to have research competencies, as only with these competencies it is possible to ensure the effectiveness of the training of students. At the same time, it is important to note that despite the obvious importance of this problem, there are still many problems in pedagogical practice regarding the development of effective methods and the use of rational pedagogical approaches to the formation of students' research thinking skills.

The problem of the research is the insufficient development of mechanisms of interaction between teachers' professional competencies and the development of students' research skills. Since it is important to establish which aspects of pedagogical competences contribute to the effective organization of teaching and research activities and how these competences influence the development of students' scientific thinking.

The object of the study is teachers' professional competencies aimed at organizing educational research activities.

The subject of the study is the processes of influence of teachers' competence in organizing educational research activities on the formation of scientific thinking in schoolchildren.

The purpose of the study is to establish the main factors and mechanisms that ensure the influence of teachers' competence in organizing educational research activities on the development of students' scientific thinking.

Objectives of the study:

- analysis of existing methods and practices aimed at organizing educational and research work at school;
- Identify the core competencies required for a teacher to be successful in conducting research activities;
- studying the relationship between the teacher's professional competence and the quality of students' research skills;
- Development of recommendations to improve the effectiveness of educational research in educational institutions.

Hypothesis of the study — if the level of research competencies of teachers directly affects the level of development of scientific thinking in schoolchildren, then teachers who have deep knowledge and skills in the field of organizing educational research are really able to effectively motivate students to research activities and thus improve the quality of education in their students.

Methods: the study was conducted using qualitative and quantitative methods of analysis. Literature analysis, observation, surveys, testing, and modeling were employed. Statistical methods were used to process the obtained data, which allowed to carry out calculations and to identify relationships between individual indicators.

Significance. The conducted research contributes to the development of theoretical and methodological basis of educational sociology, expanding the ideas about the role of pedagogical professionalism in the formation of students' research competencies. The results of the study can be used to improve the system of teacher training and retraining and to develop new standards in the field of school education.

Structure of the article: the article consists of several parts (introduction, materials and methods, results and discussion, and conclusion). The introduction provides justification of the relevance of the topic, defines the goals, objectives, subject, object, hypothesis and sociological significance of the study. The second part describes the methods and materials of the study. The third one is the results of literature analysis and empirical study. This part contains a discussion of the obtained data. The fourth part contains conclusions and recommendations for optimizing the process of organizing educational research activities in school education.

Methods and Materials

The issues of formation of teachers' competencies of research activity are quite widely covered in the works of Kazakhstani and foreign researchers. For example, A.A. Kdyrbaeva (2021) reveals the concept of "research competence" in pedagogical theory [3], A. Fatima (2024) showcase features of methodology and methods of pedagogical research [4], Sh. Taubaeva (Taubaeva Sh., 2020) [5], the theory and practice of teacher research culture. The research culture of the teacher, identified by A.D. Syzdykbaeva (2016) in her dissertation [6] and the works of A. Utilova (2025) [7], as well as scientific views of K. Kalkeyeva (2023) [8] describing the processes of formation of research and other professional qualities as a condition for the development of research culture of the teacher.

Modern foreign researchers focus on teaching methods aimed at developing research abilities of student teachers: D. Uerz (2018) [9] J. Comon (2024) [10]; V. Berbets (2024) [11]; M. Matjašič (2024) [12]; M. Levrints (2023) [13]; H. Moron-Monge (2022) [14]. It should be noted that these researchers offer a variety of approaches to the development of research competencies in teachers, based on modern pedagogical theories and practices.

At the same time, the problem of the influence of teacher's professional competencies on the formation of scientific thinking of schoolchildren remains insufficiently studied, which creates the need for further research in this area.

This research employed the following methods and used the following materials. In the analysis of literature, educational standards, model programs, methodological recommendations, scientific publications of domestic and foreign authors were studied, which reveal the issues of formation of research abilities in teachers and scientific thinking in students, as well as the influence of the educational process on the development of scientific thinking skills in the latter.

In the course of implementation of the method of pedagogical observation: during the observation of the educational process in schools in order to identify the peculiarities of the organization of educational research activities and its impact on the development of research skills among students, the State Educational Standards of the Republic of Kazakhstan [15], Model Work Programs [16], methodological recommendations for teachers containing instructions for conducting research work with students [17], samples of student work, school documentation on the activities conducted in the field of research, records of conversations with teachers and students were used. The methods of data collection were: document analysis, interviews with teachers and pupils, direct observation of classes and others. Based on the results, it was planned to identify positive and negative aspects and develop recommendations for their improvement.

When conducting the questionnaire survey, questionnaires for teachers and pupils aimed at assessing teachers research competencies, understanding the goals and objectives of teaching and research activities, and satisfaction with the learning process, were used. A total of 118 teachers and 126 students from three schools of Pavlodar city were observed. Questionnaires of teachers and students included two to five questions each on the level of formation, understanding and satisfaction. The questionnaire survey collected necessary information to analyze teaching practices and develop recommendations for improving research activities at school.

The tasks were administered during the pedagogical experiment to measure students' scientific thinking development before and after implementing educational research activities. Description of the research procedures, within the framework of this method. Participants were selected from two teacher categories: those with high research skills (they had taken additional courses to improve their research competencies and had more effective methodological recommendations) and teachers who had a lower level of such competencies (they had not taken additional training). An important condition for selection was that both teachers work in the same school and teach the same subject (biology). They teach children in classes comparable in age and level of preparation and number of pupils (7th grade). A common curriculum was developed for both groups, which includes elements of research activities. The lesson program contains similar tasks and topics, but the teacher who took the course has new recommendations and uses new methods and approaches acquired additionally. Before the experiment began, students in both groups were assessed to establish their baseline knowledge and research skills. The tests were designed to assess students' basic subject knowledge and their analytical, synthetic, and critical thinking abilities. The implementation of the experimental program took place during the quarter. The teacher, in the experimental group, uses modern research approaches, involving students in active forms of work, such as experiments, projects, analytical studies. The teacher in the control group works in a traditional way. At the conclusion of experiment, a final test mirroring the initial assessment was administered. The results were then compared to determine effectiveness. The data were analyzed to evaluate the effectiveness of research-based instruction. Key evaluation criteria included: changes in students' knowledge levels, development of research skills, student motivation and engagement, and quality of completed research projects.

Methods of statistical processing and data analysis allowed us to draw conclusions and develop practical recommendations.

The modeling of recommendations is implemented within the framework of dynamic modeling methods, as the development of scenarios requires taking into account changes in the level of teacher competencies, and development of schoolchildren's thinking depending on the time and system of organizing research activities in schools.

All the materials and methods used allowed a more comprehensive assessment of the level of teachers' competence in organizing educational research activities and the impact of these activities on the development of students' scientific thinking.

Results and discussion

John Hattie, a well-known New Zealand educator and researcher, who conducted an extensive meta-analysis of factors affecting the success of learning. In his work, A. Ibrasheva (2021) considers different approaches to teaching and points out the importance of activating methods of developing research culture among teachers [18]. A. Kariyev (2022) pays considerable attention to effective teaching methods. His work includes research on ways to prepare teachers for research and critical thinking [19]. M. Matjašič and J. Vogrinc (2024) have been active in education reform, especially in the field of science. Their study points out the importance of improving teaching methods through the introduction of scientific methods and research approach [12; 883]. M. Levrints (2023), who studies motivation and cognitive development of students, addresses in her work the issues of teachers' professional development and the role of research practice in the educational process [13; 72]. H. Moron-Monge (2022), a researcher and consultant in the field of educational strategies, has developed a system of indicators of teaching quality that includes elements of teachers' research activity [14; 2027]. All these researchers offer a variety of approaches to the development of research competencies among teachers, based on current pedagogical theories and practices. Let us define them as follows.

The main approaches to developing research competencies among educators include the following areas:

- active teacher training based on how they can then use interactive methods such as projects, case methods, and group discussions to encourage the development of critical thinking and student autonomy in research;
- personalization of learning that takes into account the interests and needs of each educator, thus fostering a deeper understanding and application of research methods;
- introduction of digital technologies to facilitate access to information and improve the quality of research;
- Collaborative approach based on creating conditions for teachers to work together on research projects, which develops their skills in teamwork and sharing their experience;
- regular evaluation and reflection of teachers' research activities to identify strengths and areas for improvement.

These approaches are based on modern pedagogical theories such as constructivism, humanistic approach and active learning technologies, and aim to build sustainable research skills in educators.

The main competences required for teachers to successfully organize research activities in schools, and were identified, based on the materials of Kazakhstani researchers. For successful organization of research activities at school and development of scientific thinking in students, a teacher should possess the following key competencies:

- methodological (understanding of the basics of scientific research methods; ability to develop hypotheses and plan experiments; mastery of statistical methods of data processing);
- organizational (ability to organize learning space for research work; time and resource management skills; ability to coordinate students' work in groups);
- communicative (effective interaction with students, colleagues and parents; establishing feedback and discussion of research results; presentation and defense of research projects);
- information-technological (use of modern information technologies to search, analyze and present data; use of specialized programs for modeling and visualization of results);
- critical thinking and creativity skills (developing the ability to analyze and synthesize information; fostering creativity in problem solving; maintaining students' interest in science and inquiry);
- emotional and psychological support skills (creating a favorable atmosphere for experimental work; supporting students in overcoming difficulties and failures; fostering self-confidence and aspiration for self-improvement);
- reflexive competencies (continuous self-development and improvement of professional skills; analysis and evaluation of one's own pedagogical activity; reflection on the results of conducted research).

Since all of the identified competencies help the teacher to effectively organize research activities, engaging students in scientific knowledge and contributing to the development of their cognitive abilities.

Results of pedagogical observation.

Our analysis of the State Educational Standard of the Republic of Kazakhstan reveals that state standards contain requirements Model working programs on subjects, from elementary school onwards, include provisions on the necessity to conduct research work, but their implementation in everyday practice for many teachers can be considered insufficient. Since only about 30 % of teachers, whose work was monitored, regularly use research approach in their work.

The assessment of methodological materials made it possible to establish the presence of detailed instructions on conducting research work with pupils. However, only 50 % of surveyed teachers confidently apply these recommendations in practice.

Examining pupils' projects revealed that about 46 % of completed projects demonstrate deep understanding of the topic and qualitative analysis of the studied material. The rest of the works require more detailed revision, moreover, many pupils were unable to draw correct conclusions due to their lack of critical thinking skills.

Reviewing schools' research activity documentation showed that only one in three schools (33.3 %) regularly organizes events related to research activities. In the other two schools, most of the organized activities remain ad hoc and do not allow forming a coherent system that can be described as an organized educational research activity.

The evaluation of the records of interviews with teachers and students, who are the main participants in the educational process, indicates that 67 % of teachers have difficulties with the proper introduction of research work in the educational process for the following reasons: lack of competencies, time and resources. While 79 % expressed interest in research activities, but they note such reasons as the need for more organization of such work and better support from teachers.

Questionnaire survey results. Table 1 shows the results of teachers' and pupils' answers.

Table 1

Results of teachers' and lecturers' answers, in percent

Questions	Response options in percentages			
<i>Results of teachers' questionnaire survey (n=118)</i>				
1. Level of formation of research competencies:				
How often are research methods used in lessons?	permanently	occasionally	infrequently	never
	19	50	25	6
What forms of research work are used?	Project	Experimental	Observations	Literature analysis
	75	45	34	56
Self-assessment of readiness to organize research work:	completely	Partially	Not ready	
	19	50	21	
The main difficulties in organizing a research paper:	Lack of time	Insufficient material base	Lack of methodological support	Low student interest
	66	44	31	19
The importance of developing research competencies in students:	It's very important	It's important enough	It doesn't matter	
	84	10	6	

Continuation of Table 1

Questions	Response options in percentages			
<i>Results of teachers' questionnaire survey (n=118)</i>				
2. Understanding students' needs and knowledge:				
Ways to identify students' needs and interests:	Surveys and interviews	Orientation to the school program	Following the recommendations of the manuals	Others
	40	31	19	10
Taking into account individual characteristics and level of preparation of pupils:	Individualization of tasks	Offering different levels of complexity	Working in groups with different levels	Application of other methods
	25	50	19	6
Assessing students' knowledge and skills:	Testing and quizzes	Testing and quizzes	Questionnaire and self-assessment	Other ways
	59	19	16	6
3. Satisfaction with the process of training organization:	Completely	Partially	Not satisfied	
	31	50	19	
Evaluating the conditions for research work:	Great	The good ones	Satisfactory	The bad ones
	16	50	31	13
Necessary changes in the organization of research work:	Improvement of material and technical base:	Increase in the number of hours	Providing methodological assistance	
	44	21	35	
<i>Pupils' questionnaire results (n=126)</i>				
1. Understanding the goals and objectives of educational and research activities:				
Understanding the essence of teaching and research activities:	Project execution and competitions	Conducting experiments	Literature study and essay writing	
	50	31	19	
Purpose of the teaching and research activity:	Development of creative abilities	Gaining new knowledge	Preparation for the profession	
	50	31	19	
Frequency of participation in research work:	Often	Sometimes	Rarely	Never
	20	50	25	5
2. Satisfaction with teachers' research competencies and organization of the teaching process:				
Satisfaction with teachers' research competencies:	Completely	Partially	Not satisfied	
	20	44	31	
Evaluation of the organization of research work in the school:	That's great	All right	Satisfactory	Bad
	19	50	25	6

Questions	Response options in percentages			
<i>Pupils' questionnaire results (n=126)</i>				
The most appealing aspects of the research paper:	Independent search for information	Teamwork	Interesting projects	Other
	31	31	20	8
Barriers to active participation in research:	Lack of time	Task complexity	Not interesting enough	Other
	40	31	19	10
Suggestions for improving the research work:	More time for projects	More interesting topics	Help from teachers	
	50	31	19	

The obtained data allow us to draw the following conclusions. The level of research competence formation among teachers is characterized by the use of research methods. At the same time, it was found that most teachers (50 %) sometimes use such methods, while only (19 %) use them consistently. Thus, these data indicate that there is an interest in introducing research practices, but there is a rather large group of teachers who rarely or not at all use these approaches (31 %). The most common forms are project work (75 %) and literature analysis (56 %). Experimental research and observation are also used by teachers, but less frequently (45 % and 34 %, respectively). Only 19 % of teachers are fully ready to organize research work, 50 % are partially ready, and 21 % are not ready at all. These data may indicate the need for additional training and methodological support. Teachers identify time constraints (66 %), insufficient material resources (44 %), and inadequate methodological support (31 %) as the main obstacles. Low interest of pupils is mentioned less frequently (only 19 %). The importance of pupils' research competencies development is noted by the overwhelming majority of teachers (84 %), which confirms the high importance of this competency among teachers themselves in school education.

Most respondents (40 %) consider surveys and interviews the primary method for understanding pupils' needs and knowledge, reflecting their focus on individual student characteristics. Orientation to the school curriculum (31 %) and following the recommendations of methodological guides (19 %) are also recognized as important for teachers. Considering individual peculiarities and pupils' training level: the most popular method is offering different levels of task complexity (50 %), followed by individualization of tasks — 25 %, and working in groups with varying needs — only 19 %. Assessment of pupils' knowledge and skills is carried out mainly through testing and control works (59 %), while questionnaires and self-assessment are considered less applicable (19 % and 16 %, respectively).

Satisfaction with the process of research training organization: only one third of teachers or 31 % are fully satisfied, half (50 %) are partially satisfied, and 19 % are not satisfied. At the same time, half of teachers assess the conditions as good (50 %), but a significant number (31 %) consider them satisfactory, and 13 % — poor. This indicates that there are problems in this area. Teachers most often consider improvement of material and technical base (44 %) and provision of methodical assistance (35 %) as necessary changes.

Pupils understand the goals and objectives of teaching-research activity as follows: half of pupils associate it with project implementation and competitions (50 %), while 31 % — with experiments and 19 % — with literature study. They consider the development of creative abilities (50 %) and acquisition of new knowledge (31 %) to be the goals of educational-research activities, while research work is less important to them for preparation for a profession (only 19 %). In terms of frequency of participation in research work: only half of pupils participate sometimes (50 %), the rest participate less often or not at all (31 % and 19 %).

Pupils note the following satisfaction with teachers' research competences and organization of the learning process: only 20 % of pupils are fully satisfied with teachers' research competences, 44 % are partially satisfied with their competences, and 31 % are dissatisfied. It is necessary to recognize these indicators as low and define them as average level of satisfaction. In relation to the organization of research work at school, pupils' assessments are similar to teachers' assessments: the majority considers the organization to be

good (50 %), but there is a significant percentage of those who assess it as satisfactory (25 %) or even bad (6 %). Pupils see the attractiveness of research work in independent information search and teamwork (31 % each), while interesting projects attract fewer pupils (only 20 %). Lack of time (40 %) and complexity of tasks (31 %), as well as insufficiently interesting organization (19 %) are considered the main problems for active participation in research. Teachers need to pay special attention to these problems. Suggestions for improvement on the part of students were: giving more time for projects (50 %) and suggesting more interesting topics (31 %), as well as help from teachers mentioned (19 % in total).

The results of the pedagogical experiment are reflected according to Figure 1.

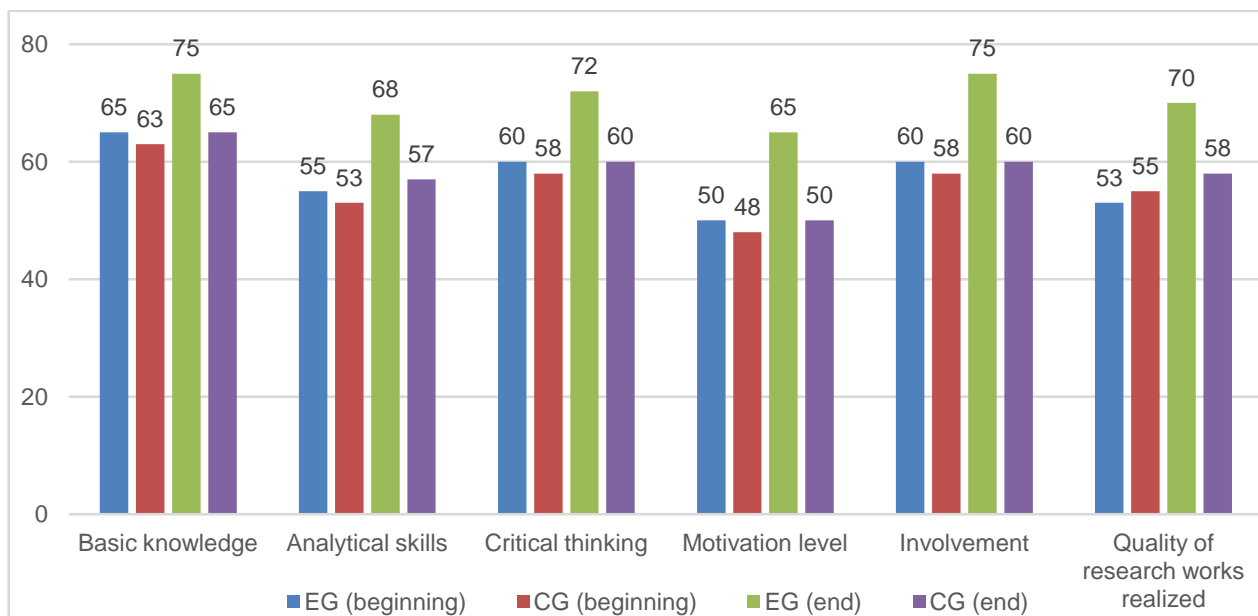


Figure 1. Test results before and after the experiment

Based on the presented data, the following conclusions can be drawn. At the final stage, there is a significant improvement of indicators in the experimental group (EG). At the same time, all indicators in the EG significantly increased compared to the control group (CG): basic knowledge increased by 10 %; analytical skills — by 11 %; critical thinking — by 12 %; the level of motivation increased by 15 %; involvement increased by 15 %; the quality of realized research works improved by 12 %. Such indicators indicate a positive effect of the introduction of research activities in the educational process. At the same time, the control group showed less pronounced improvement, as basic knowledge increased by 2 %; analytical skills increased by 4 %; critical thinking, motivation level, and involvement increased by 2 %, and the quality of realized research works increased by 3 %. These modest improvements may indicate that traditional teaching methods are less effective in developing the above-mentioned skills.

The analysis revealed that indicators related to active student participation showed the greatest improvement. Specifically, motivation, involvement, and research work quality demonstrated the highest gains. This highlights the importance of proper organization of research activities for the formation of a sustainable interest in learning and deep understanding of the material and demonstrates benefits of the experimental group. Since the EG showed significantly better results in all parameters, which confirms the effectiveness of using the teacher's competencies in organizing research in the learning process. Because their competence that allowed EG students not only to improve their basic knowledge, but also to develop analytical skills, critical thinking and increase their motivation to learn.

Identification of key factors and mechanisms. Based on the comprehensive analysis of empirical data, literature review, and experimental results, the key factors and mechanisms ensuring the influence of teachers' competence on the development of students' scientific thinking were identified.

The key factors influencing the development of students' scientific thinking include:

1) Teacher's research competence level (C) — comprising methodological, organizational, communicative, information-technological, critical thinking, emotional-psychological support, and reflexive competen-

cies. The experimental data demonstrated that teachers with higher competence levels (after additional training) achieved 10-15 % better student outcomes across all measured parameters.

2) Quality and systematicity of research activities organization (Q) — reflected in the regularity, structure, and methodological rigor of research work implementation. Observations reveal that only 33.3 % of schools maintain systematic research activities, while 66 % of teachers cite organizational challenges as primary barriers.

3) Students' baseline cognitive abilities and motivation (S_0) — the initial level of knowledge, analytical skills, and interest in learning. Pre-experiment testing established comparable baseline levels between experimental and control groups, enabling valid comparison of outcomes.

4) Resource availability (R) — including methodological support, material-technical base, and time allocation. Survey data indicated that 44 % of teachers identify inadequate resources and 66 % cite time constraints as significant limiting factors.

The key mechanisms through which teachers' competence influences students' scientific thinking development are:

1) Competence transfer mechanism (M_1) — the direct transmission of research skills from teacher to students through modeling, demonstration, scaffolding, and guided practice. This mechanism operates through the teacher's ability to break down complex research processes into learnable steps and provide appropriate support. The experimental group showed superior development of analytical skills (+11 %) and critical thinking (+12 %), confirming effective competence transfer.

2) Motivational enhancement mechanism (M_2) — stimulation of students' cognitive interest and intrinsic motivation through engaging, meaningful research activities that connect to students' interests and real-world applications. The experimental data revealed the strongest effects in motivation (+15 %) and engagement (+15 %), demonstrating this mechanism's potency when properly activated.

3) Developmental progression mechanism (M_3) — gradual, cumulative formation of analytical skills, critical thinking, and scientific reasoning through systematic, sustained involvement in progressively complex research activities over time. This time-dependent mechanism explains why systematic organization (not sporadic activities) is essential for meaningful outcomes.

4) Feedback and adjustment mechanism (M_4) — continuous assessment, reflection, and responsive modification of the educational process based on students' progress, challenges, and needs. This bidirectional mechanism ensures the educational process remains appropriately challenging and supportive, optimizing learning conditions.

These factors and mechanisms operate synergistically rather than isolation. The model demonstrates that teacher competence (C) activates the transfer mechanism (M_1), which combined with organizational quality (Q) engages the motivational mechanism (M_2). Together, these create conditions for the developmental mechanism (M_3) to operate effectively over time (t), while the feedback mechanism (M_4) continuously optimizes the process based on student responses and resource constraints (R). The synergistic interaction of all elements produces the observed significant improvements in students' scientific thinking.

Based on the available indicators, the proposed model of teacher competencies development aimed at influencing students' scientific thinking can be represented by a formula based on dynamic modeling. The model of teacher's competences development and their influence on scientific thinking is schematically presented in Figure 2.

The model incorporates all identified key factors and mechanisms in an integrated dynamic framework. The key elements include: teacher's research competence level (C), representing all seven competency domains identified earlier; students' scientific thinking level (S), encompassing basic knowledge, analytical skills, critical thinking, motivation, and engagement; organizational quality (Q), reflecting the systematicity and structure of research activities; resource availability (R), including time, materials, and methodological support; and time factor (t), capturing the cumulative developmental nature of learning.

The model explicitly represents the four key mechanisms: (1) the competence transfer mechanism (M_1) is shown through the direct functional relationship between C and the rate of change in S; (2) the motivational enhancement mechanism (M_2) operates through the interaction between Q and student engagement components of S; (3) the developmental progression mechanism (M_3) is captured through the time-dependent accumulation reflected in the differential equation structure with parameter t; (4) the feedback and adjustment mechanism (M_4) is represented by the bidirectional influences where current states of S and Q affect the effectiveness of C application, creating adaptive loops that optimize the educational process. The model

assumes dynamic changes over time, with each state depending on previous states, and captures the multiplicative interactions between factors that create synergistic effects exceeding simple additive contributions.

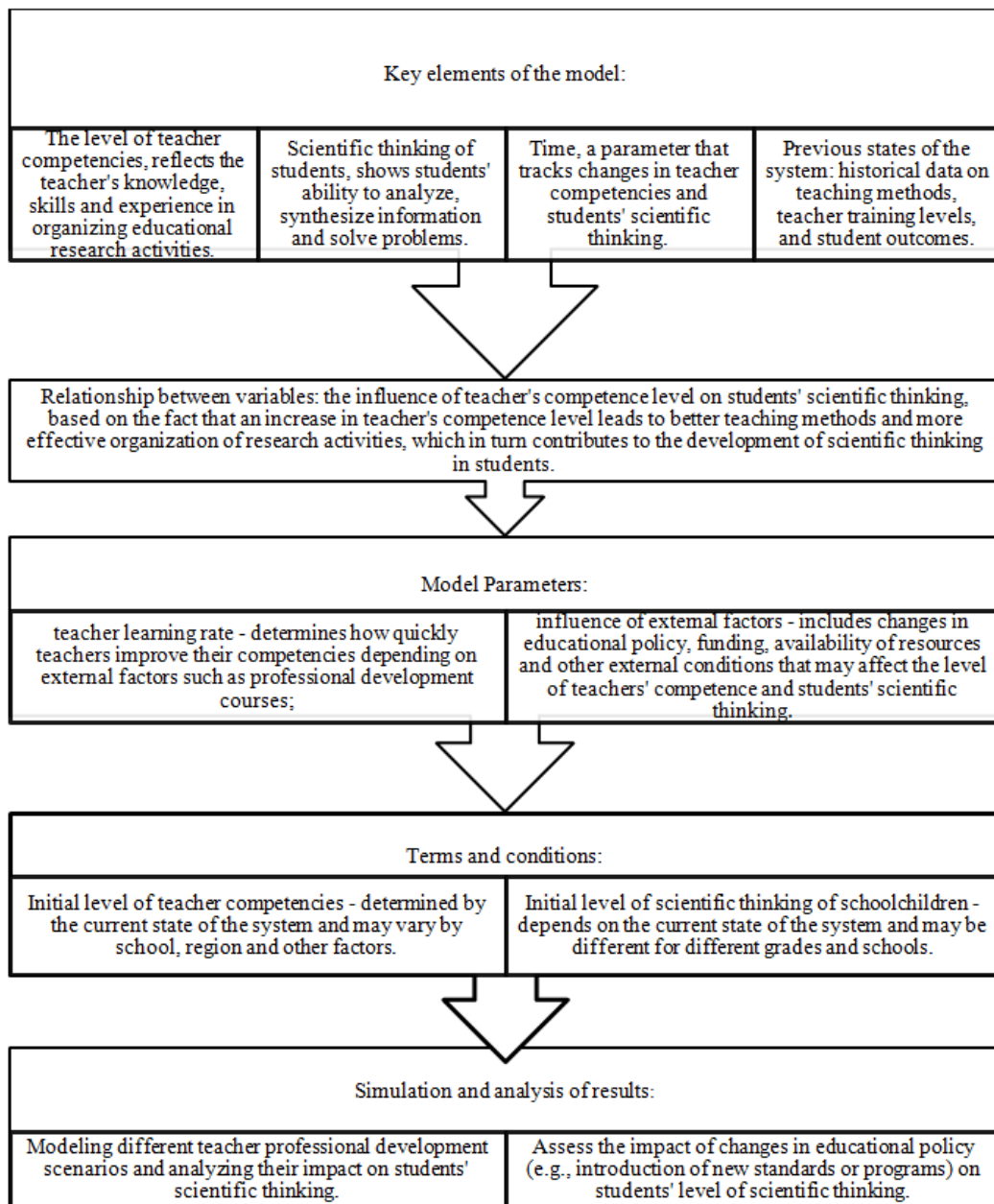


Figure 2. Model of development of teacher competencies and organization of research activities and their influence on scientific thinking of schoolchildren

Based on the identified key factors and mechanisms, three sets of evidence-based recommendations emerged:

Recommendations targeting teacher competence factor (C) and activating transfer mechanism (M_1):

- Implement comprehensive professional development programs addressing all seven competency domains (methodological, organizational, communicative, information-technological, critical thinking, emotional-psychological, and reflexive), as experimental evidence demonstrated 10-15 % improvement in student outcomes when teachers received such training;

- Establish mentorship systems where experienced research-oriented teachers model effective practices for colleagues, leveraging the competence transfer mechanism;

- Provide ongoing methodological support addressing the 31 % of teachers who cite inadequate methodological assistance as a barrier.

Recommendations targeting organizational quality (Q) and resource availability (R) to engage motivational (M₂) and developmental (M₃) mechanisms:

- Institutionalize systematic, regularly scheduled research activities rather than sporadic events, addressing the finding that only 33.3 % of schools currently maintain systematic programs;

- Allocate dedicated time for research work, responding to the 66 % of teachers and 40 % of students who identify time constraints as primary barriers;

- Improve material-technical base, addressing the concerns of 44 % of teachers, to provide adequate resources for experimental and project-based work;

- Implement diverse, engaging research formats (projects, experiments, observations, analysis) that connect to students' interests, as 50 % of students identified interesting topics as key to improvement.

Recommendations optimizing feedback and adjustment mechanism (M₄) to enhance overall system effectiveness:

- Establish regular assessment cycles monitoring both student progress and program implementation quality, enabling responsive adjustments;

- Create structured reflection opportunities for both teachers (addressing reflexive competence development) and students (fostering metacognitive skills);

- Develop school-level research cultures with collaborative planning, shared resources, and collective problem-solving to address challenges;

- Implement differentiated approaches accommodating diverse student needs, as survey data revealed significant variation in student readiness and interest levels.

These recommendations directly address the identified factors and systematically activate the key mechanisms, creating conditions for synergistic improvement in students' scientific thinking development.

Conclusion

Thus, this study identifies effective psychological and pedagogical technologies that stimulate students' cognitive activity and in determining the effectiveness of their implementation in the professional training of future educational psychologists. The results of pedagogical observation demonstrate a clear advantage of approaches based on the organization of research activities over traditional methods of learning. This confirms the necessity of introducing such methods in the educational process to achieve high results in the development of students. At the same time, it should be noted that research activities are currently being actively introduced at the school level in the learning process, but there are some difficulties, primarily related to insufficient organization, limited resources, time and methodological support. The importance of developing research competencies is recognized by most teachers, but the level of their readiness to organize such work leaves much to be desired. Most pupils understand the importance of research activities, especially in the main context of developing creative abilities and acquiring new knowledge, but experience such barriers as lack of time and complexity of the supplied tasks. The findings indicate the need to improve the organizational and competence development for both teachers and students.

The conclusions drawn above are consistent with the hypothesis of the study, according to which it is assumed that a high level of teachers' research competencies contributes to the effective development of scientific thinking in schoolchildren. Analyzing the results of the experiment confirms this relationship, as increasing the level of research competencies of the EG teacher led to a more significant improvement in the results of students in the experimental group. Since this teacher had high research competencies due to additional training. As a result, students showed significant improvement in all key indicators: basic knowledge, analytical skills, critical thinking, motivation and engagement, and quality of research papers. Thus, it is found that teachers with developed research competencies can effectively transfer these skills to their students. At the same time, the traditional teaching methods used by the teacher in CG were less effective, as the students showed insignificant changes in all the indicators. Such results indicate that for qualitative development of scientific thinking, specially organized teaching and sufficient level of competence of teachers are necessary. At the same time, it is noted that the organization of research activities increases motivation and involvement. Since the greatest increase in the indicators of motivation, involvement and quality of research works in EG indicates that participation in research activities helps pupils to become interested in scientific knowledge and learn the material more deeply.

The model of teacher competence development and organization of research activities and their impact on students' scientific thinking includes key elements of the model, parameters, conditions, simulation and analysis of results. It is important to note that the model assumes that changes occur over time, and at each time step the previous state of the system and the relationship between all variables must be taken into account. Using this model, it is possible to improve teachers' competence in organizing educational research activities to increase the impact on the development of students' scientific thinking.

Our study obtained data confirming the importance of systematic approaches to developing research competencies among pedagogical university students. This is consistent with the conclusions of A.D. Syzdykbaeva, who emphasized the importance of purposeful development of research skills in teachers. It was also found that active learning methods enhance students' motivation and involvement, which corresponds to the observations of J. Comon and V. Berbets. In addition, the study showed the effectiveness of implementing technologies to enhance the quality of the educational process, such as personalized learning and the use of digital resources. These findings correlate with the ideas of M. Matjašič, who points out the importance of innovative practices in education. Finally, the findings confirm the need for a comprehensive approach to assessing student learning proposed by H. Moron-Monge which includes various aspects of research-based learning activities. Thus, the results of this study complement existing knowledge in the field of teacher education and contribute to the understanding of the processes of developing professional competencies in future teachers.

Scientific novelty of the work consists in the application of a comprehensive approach to the study of the process of formation of competence of school teachers regarding the organization of students' research activities. At the same time, the study examines this process from the point of view of modern pedagogical methods and technologies, which makes it possible to identify new aspects and trends in the educational process. The practical value of the obtained results consists in the possibility of their application in real conditions of pedagogical practice. The results and recommendations can be used to develop new curricula and methodological recommendations aimed at improving teachers' competence in organizing educational research activities and their impact on the development of scientific thinking of schoolchildren.

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Ж.Т. Кенжебаева, Ж.Е. Алибаева, А.К. Нургалиева, А. Расола

Педагогтердің оқу-зерттеу қызметін ұйымдастырудағы құзыреттілігі және олардың оқушылардың ғылыми ойлауын дамытуға әсері

Мақала мұғалімдердің білім беру және зерттеу іс-шараларын ұйымдастырудағы құзыреттерінің оқушылардың ғылыми ойлау және когнитивтік-аналитикалық дағдыларын дамытуға әсерін зерттейді. Зерттеу мәселесі мұғалімдердің кәсіби құзыреттерін оқушылардың зерттеу қабілеттерін қалыптастырумен байланыстыратын дамытылған механизмдердің жеткіліксіздігінен туындайды. Зерттеудің мақсаты — мұғалімдердің білім беру және зерттеу іс-шараларын жоспарлау және жүзеге асырудағы құзыреттері мектеп оқушыларының ғылыми ойлау қабілетін дамытуға ықпал ететін негізгі факторлар мен механизмдерді анықтау. Зерттеу әдістеріне әдеби шолу, бақылау, сауалнама, тестілеу және модельдеу кірді. Эксперимент нәтижелері зерттеу гипотезасына сәйкес келеді, себебі мұғалімдердің зерттеушілік құзыреттерін жетілдіру мен эксперименттік топ оқушыларының нәтижелерін жақсарту арасындағы байланыс, атап айтқанда олардың когнитивтік белсенділігі, оқу мотивациясы және білім беру процесіне жалпы қатысуы расталды. Мұғалімдердің құзыреттерін дамыту моделі жасалды. Зерттеудің ғылыми жаңалығы бастауыш мектеп мұғалімдері арасында зерттеу қызметін ұйымдастыру саласындағы құзыреттілікті қалыптастыру үдерісін зерттеуге кешенді тәсілді қолдануда жатыр. Ал практикалық маңызы ұсынылған модельді және алынған нәтижелерді нақты педагогикалық тәжірибеде қолдану мүмкіндігінде: оларды болашақ мұғалімдерді даярлайтын университеттік бағдарламаларды жетілдіру, мақсатты кәсіби даму курстарын әзірлеу және нақты сынып жағдайында оқушылардың когнитивтік белсенділігі мен оқу мотивациясын арттыратын тиімді психологиялық-педагогикалық технологияларды енгізу үшін қолдануға болады.

Кілт сөздер: мұғалімнің құзыреттілігі, оқушылар, ойлау, қазіргі жағдайда білім беру, қызметті ұйымдастыру, ғылыми ойлау, білім беру технологиялары, академиялық дағдылар.

Ж.Т. Кенжебаева, Ж.Е. Алибаева, А.К. Нургалиева, А. Расола

Компетенции педагогов в организации учебно-исследовательской деятельности и их влияние на развитие научного мышления учащихся

В статье исследуется влияние компетенций учителей в организации образовательной и исследовательской деятельности на развитие научного мышления и когнитивно-аналитических навыков учащихся. Проблема исследования обусловлена недостаточностью разработанных механизмов, связывающих профессиональные компетенции учителей с формированием исследовательских способностей учащихся. Цель исследования — выявить ключевые факторы и механизмы, посредством которых компетенции учителей в планировании и реализации образовательной и исследовательской деятельности способствуют развитию научного мышления у школьников. Методы исследования включали анализ литературы, наблюдение, опросы, тестирование и моделирование. Результаты эксперимента согласуются с гипотезой исследования, поскольку была подтверждена связь между повышением исследовательских компетенций учителя и улучшением результатов учащихся в экспериментальной группе, в частности в их познавательной деятельности, мотивации к обучению и общей вовлеченности в образовательный процесс. Была создана модель развития компетенций учителей. Научная новизна заключается в применении комплексного подхода к изучению процесса формирования компетенций в области организации исследовательской деятельности у учителей начальной школы. Практическая значимость исследования заключается в возможности применения предложенной модели и полученных результатов в реальной педагогической практике: они могут быть использованы для совершенствования университетских программ подготовки будущих педагогов, разработки целевых курсов профессионального развития и внедрения эффективных психолого-педагогических технологий, повышающих познавательную активность и мотивацию к обучению учащихся в реальных условиях классной комнаты.

Ключевые слова: компетенции учителя, школьники, мышление, образование в современных условиях, организация деятельности, научное мышление, образовательные технологии, академические навыки.

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