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MODERN RESOURCES AND TECHNOLOGIES AS A FOUNDATION FOR THE DEVELOPMENT OF TEACHERS' PROFESSIONAL COMPETENCIES

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Abstract. The relevance of the study is determined by the digital transformation of education and the active integration of information and communication technologies, which increases the need for systematic support of teachers' professional development. Despite the widespread use of digital educational resources, there remains a shortage of comprehensive instrumental and methodological solutions aimed at developing teachers' professional and ICT competencies in accordance with their individual and professional needs. The purpose of the study is to develop and experimentally validate the effectiveness of an instrumental and methodological platform as a means of enhancing teachers' professional and ICT competencies. To achieve this purpose, scientific and pedagogical literature was analyzed, a model of methodological support for teachers was developed, the platform was tested experimentally, and the dynamics of ICT competency development across its main components were assessed. The results of the study showed that the use of the platform contributes to the positive development of teachers' ICT competencies, increases their professional motivation, digital literacy, and readiness to apply modern technologies in the educational process. It was also found that the platform supports the formation of individual learning trajectories, expands teachers'

participation in professional communities, and strengthens interdisciplinary integration. In addition, the platform provides opportunities for continuous feedback, reflective practice, exchange of pedagogical experience, and more flexible planning and monitoring of teachers' professional growth within educational organizations. The practical significance of the study lies in the possibility of using the obtained results for organizing methodological support for teachers, designing professional development programs, and implementing digital educational platforms in general and continuing education systems.

Keywords: Instrumental and methodological platform, support, educational organizations, ICT, competencies

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ПЕДАГОГТЕРДІҢ КӘСІБИ ҚҰЗЫРЕТТІЛІГІН ДАМУДЫҢ НЕГІЗІ РЕТІНДЕ ҚАЗІРГІ ЗАМАНҒЫ РЕСУРСТАР МЕН ТЕХНОЛОГИЯЛАР

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Аннотация. Зерттеудің өзектілігі білім беруді цифрлық трансформациялау және ақпараттық-коммуникациялық технологияларды белсенді енгізумен байланысты, бұл педагогтердің кәсіби дамуын жүйелі қолдау қажеттілігін арттырады. Цифрлық білім беру ресурстарының кеңінен қолданылуына қарамастан, педагогтердің жеке және кәсіби қажеттіліктерін ескеретін кәсіби және АКТ-құзыреттіліктерін дамытуға бағытталған кешенді аспаптық-әдістемелік шешімдердің жеткіліксіздігі сақталуда. Зерттеудің мақсаты педагогтердің кәсіби және АКТ-құзыреттіліктерін дамыту құралы ретінде аспаптық-әдістемелік платформаның тиімділігін әзірлеу және эксперименттік

тұрғыда тексеру болып табылады. Осы мақсатқа жету үшін ғылыми-педагогикалық әдебиеттерге талдау жүргізілді, педагогтерді әдістемелік сүйемелдеу моделі әзірленді, платформа тәжірибелік-эксперименттік түрде сыналды және АКТ-құзыреттіліктерінің негізгі компоненттері бойынша қалыптасу динамикасы бағаланды. Зерттеу нәтижелері платформаны қолдану педагогтердің АКТ-құзыреттіліктерінің оң дамуына, олардың кәсіби уәжінің, цифрлық сауаттылығының және білім беру үдерісінде заманауи технологияларды қолдануға дайындығының артуына ықпал ететінін көрсетті. Сонымен қатар, платформа педагогтердің жеке білім беру траекторияларын қалыптастыруға, кәсіби қауымдастыққа қатысуын кеңейтуге және пәнаралық ықпалдастықты күшейтуге мүмкіндік беретіні анықталды. Бұдан бөлек, платформа тұрақты кері байланыс орнатуға, рефлексиялық қызметті дамытуға, педагогикалық тәжірибе алмасуға, сондай-ақ білім беру ұйымдарында педагогтердің кәсіби дамуын икемді жоспарлау мен мониторинг жүргізуге жағдай жасайды. Зерттеудің практикалық маңыздылығы алынған нәтижелерді педагогтерді әдістемелік қолдауды ұйымдастыруда, біліктілікті арттыру бағдарламаларын әзірлеуде және жалпы және қосымша білім беру жүйесіне цифрлық платформаларды енгізуде қолдану мүмкіндігімен анықталады.

Түйін сөздер: Аспаптық және әдіснамалық платформа, қолдау, білім беру ұйымдары, акт, құзыреттер

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СОВРЕМЕННЫЕ РЕСУРСЫ И ТЕХНОЛОГИИ КАК ОСНОВА РАЗВИТИЯ ПРОФЕССИОНАЛЬНЫХ КОМПЕТЕНЦИЙ ПЕДАГОГОВ

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Аннотация. Актуальность исследования обусловлена цифровой трансформацией образования и активным внедрением информационно-коммуникационных технологий, что обуславливает возрастание потребности в системной поддержке профессионального развития педагогов. Несмотря на

широкое использование цифровых образовательных ресурсов, сохраняется недостаток комплексных инструментально-методических решений, направленных на развитие профессиональных и ИКТ-компетенций педагогов с учётом их индивидуальных и профессиональных потребностей. Целью исследования является разработка и экспериментальная оценка эффективности инструментально-методической платформы как средства развития профессиональных и ИКТ-компетенций педагогов. Для достижения поставленной цели проведены анализ научно-педагогических источников, разработка модели методического сопровождения педагогов, экспериментальная апробация платформы и оценка динамики формирования ИКТ-компетенций по основным компонентам. Результаты исследования показали, что использование платформы способствует развитию ИКТ-компетенций педагогов, повышению их профессиональной мотивации, цифровой грамотности и готовности к применению современных технологий в образовательном процессе. Установлено также, что платформа способствует формированию индивидуальных образовательных траекторий, расширяет участие педагогов в профессиональном сообществе и усиливает межпредметную интеграцию. Кроме того, платформа обеспечивает возможности для постоянной обратной связи, развития рефлексивной деятельности, обмена педагогическим опытом, а также более гибкого планирования и мониторинга профессионального роста педагогов в образовательных организациях. Практическая значимость состоит в возможности использования полученных результатов при организации методического сопровождения педагогов, разработке программ повышения квалификации и внедрении цифровых образовательных платформ в системе общего и дополнительного образования.

Ключевые слова: Инструментальная и методологическая платформа, поддержка, образовательные организации, ИКТ, компетенции

Introduction. Teachers should be ready to use new technologies in the educational environment (Zulpykhar, 2025) to ensure effective learning and development of students. In the process of modernization of education related to the development of information and communication technologies, new opportunities for the educational process are opening up. Teachers should apply the skills and competencies that become necessary in the conditions of the informatization of society and education (Baydjanov, 2021). The authors describe several skills and competencies that teachers should possess:

1. Digital literacy: the ability to effectively use information and communication technologies to search, evaluate, analyze, and process information.
2. Computer thinking: ability to formulate and solve problems using concepts and methods of computer science.
3. Information security: awareness of possible threats to information security and the ability to protect your information.

4. Critical thinking: the ability to analyze information, evaluate its reliability, and make informed decisions.

5. Communication skills: the ability to communicate and collaborate effectively in virtual environments (Mukasheva, 2023).

6. Creativity and innovation: the ability to generate new ideas, develop innovative solutions, and find non-standard approaches to solving problems.

7. Self-organization and self-motivation (Zulpykhar, 2025): the ability to plan your activities, work independently, and motivate yourself to achieve your goals.

This will help make the learning process (Karelkhan, 2024) more interactive, accessible, and effective. Teachers with ICT skills can effectively use online resources for self-education and professional development. They can study new teaching methods, get access to up-to-date scientific and methodological literature and lectures, and exchange experiences with colleagues around the world.

Literature review. One of the main reasons for this problem is the lack of time and resources to master the necessary skills in the field of information technology (Seitakhmetova, 2022). To solve this problem, it is necessary to provide teachers with access to modern means of informatization and create special educational programs that would help them master the necessary skills. In addition, it is important to change the approach to teacher training by including mandatory courses in information technology (Kopeyev, 2020) in the curriculum.

The analysis of scientific and pedagogical research and the current situation in the practice of the formation of professional competence of teachers through an instrumental and methodological platform allows us to identify the following contradictions:

1. Despite the proliferation of educational platforms, access to them and the quality of equipment may vary significantly in different regions and educational institutions. This creates an inequality in the ability of teachers to develop their professional skills.

2. Teachers have limited working hours and may face difficulties in finding time to learn new pedagogical approaches and methods. This may reduce their motivation and opportunities for professional development.

3. Teachers may feel apprehension and resistance before introducing new technologies into the educational process, especially if they do not have sufficient support and feedback. The purpose of methodological support is the systematic creation of organizational, educational, technical, and informational conditions for systematic self-development. The development of an integrated system of methodological support should be based on the principles of scientific character, predictability, flexibility, mobility, and continuity. Taking into account these principles, the process of teacher development becomes an interaction of a creative laboratory of joint searches and the introduction of educational innovations into the system of pedagogical activity.

Among the functions of methodological support for the pedagogical development of teachers, we define the following: educational, advisory, service, coaching, adaptation, expert, moderation, corrective-reflexive, and others.

The organization of such events can include various ways and means, including modern educational technologies, information and communication technologies, distance learning, game methods, dialogues, focus groups, tutoring, team building and other interactive activities. An obligatory part of these methods is reflection, it is necessary for professional development and shows how well everyone interacts in a system of continuous pedagogical growth.

Methodical assistance to teachers is a system of consultations, coaching, support for creative teams, school-wide seminars and teacher councils (Higuera-Rodríguez, 2020). They help to share experiences and can be conducted actively (discussions, business games, trainings) and passively (presentations at meetings and teacher councils, questionnaires, surveys, acquaintance with printed materials). Methodological assistance also includes the creation of resource rooms and consulting centers where teachers can participate in courses, conferences, methodological associations, round tables, seminars and master classes (Zhang, 2022). Mentors help teachers involved in research and experimentation, and information helps them participate in conferences, workshops, and professional skills competitions to show and spread their expertise.

It turns out that methodological support is a necessary, organized process that helps teachers grow in their profession and develop their skills. In dictionaries, support is support, guidance, and help. The idea of pedagogical support belongs to O. Gazman, (Gazman, 2018) who identified a separate area – the pedagogy of self-awareness, where teachers help students become independent.

Research shows that teachers in schools need to be supported comprehensively and in different ways. This is how schools can adapt to the interests, needs, and characteristics of each teacher. This gives teachers freedom of choice, motivates them to learn and develop, and personal needs meet the demands of society and changes in education.

To share their experience, Astana hosts many different events for teachers: conferences, seminars, methodological classes, round tables and master classes. Teacher support means helping to determine the direction of development and increase responsibility for their work.

In this regard, organizational and methodological support is considered as a single process that helps teachers grow in the profession, develop their skills and promote teaching, as well as coordinate the work of different subjects. Based on this approach, Astana has created a special teacher support model that combines online and offline formats. All this works on a special platform that helps to properly allocate resources.

Figure 1 shows a hybrid, personalized model of methodological support for teachers in Astana. She focuses on an individual approach to providing assistance and forms a positive attitude towards the profession, which corresponds to the traditional approach to working with teaching staff. The model ensures a smooth and individual transition in the professional development system, taking into account the needs, experience and professional interests of teachers.

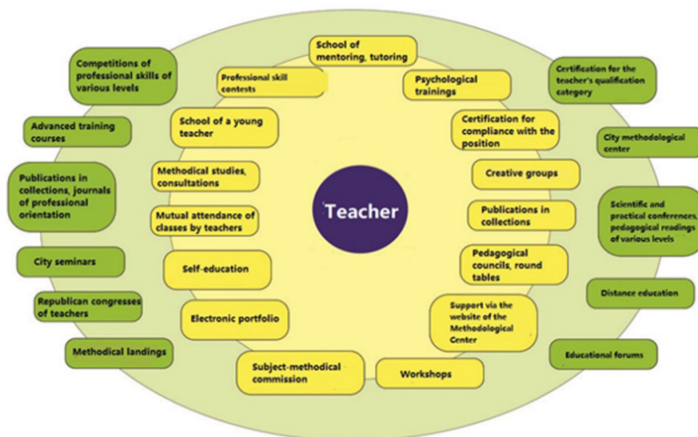


Figure 1 - Model of instrumental and methodological support of teaching staff

In this model, online support is combined with offline methods in a mixed format. Resource management and coordination are carried out through a platform developed by the authors of the study. The main content of the resources is implemented to provide advice to teachers, conduct practical psychological and pedagogical seminars, trainings, webinars, round tables and master classes.

The scientific novelty of the study is that:

1. new methodological tools, techniques and technologies have been developed and implemented to improve the quality of education.
2. the transition to digital resources hosted on an instrumental and methodological platform within the framework of methodological support for teachers' activities has been ensured;
3. online and offline forms of methodological support were provided in the context of the implementation of the priority national project "Quality Education "Educated Nation".

Materials and methods. The purpose of the experimental work is to evaluate the effectiveness of the implementation of an instrumental and methodological platform for accompanying teachers in the development of the discipline "Geography" and "Computer Science". The authors analyze how the instrumental and methodological platform can be used taking into account the specifics of subjects, curricula, and a group of teachers. Approaches to using the platform may vary depending on the subjects, as each subject has its own specific requirements and learning objectives (Abylkassymova, 2020). In many cases, teachers require methodological support and training to effectively use new knowledge and skills in their practice. When choosing teaching methods (Salmon, 2012) using an instrumental and methodological platform, it is important to take into account their convenience and effectiveness for specific groups of teachers and their ability to successfully integrate these technologies into the educational process. G. Salmon point out that platforms can significantly strengthen and improve methodological support

in learning by providing students with access to extensive information, interactive resources, and learning tools. They emphasize that methodological support using the educational platform makes it possible to diversify educational materials, attract students to active participation, and stimulate their academic achievements. Nesje K. And Lejonberg E. speak about the importance of methodological support with the use of an instrumental and methodological platform in the context of teaching teachers (Nesje, 2022). He points to the potential of the platform that helps teachers develop their professional skills and improve the quality of education. Sofi-Karim M. et al., considers methodological support using the online platform in the context of the development of media education (Sofi-Karim, 2023). Rogti M. notes that the instrumental and methodological platforms allow students to actively interact with a variety of media resources (for example, video, audio, and graphics) and develop critical thinking, communication skills, and the ability to cooperate (Rogti, 2024).

The implementation of the concept of pedagogical effectiveness on methodological support with the use of an instrumental and methodological platform for teachers was carried out in a contingent of organized groups. Experimental work was carried out to assess the effectiveness and usability of the platform for methodological support of teachers. Within the framework of this concept, teachers received support and support in using the instrumental and methodological platform in their teaching activities. Special webinars, seminars, and training were developed and conducted, which helped teachers to master new technologies and effectively apply them in the educational process. Organized groups of teachers started using the educational platform in their pedagogical practice, which allowed them to significantly improve the quality of education and make the learning process more interesting and accessible to students. New methodological materials, lessons, and programs adapted for teachers were developed and implemented. Teachers actively used computer programs, multimedia presentations, interactive whiteboards, and other ICT tools in their work. This allowed teachers to make the learning process more visual, interactive, and accessible to all students. The results of the implementation of the concept of pedagogical efficiency using the instrumental and methodological platform were positive. Teachers have become more confident and motivated in their work, which has led to an improvement in their professional skills and student learning outcomes. Students have become more active and interested in the learning process thanks to the introduction of new technologies.

The purpose of this study is to assess the professional competence of teachers using a diagnostic complex that includes quantitative and qualitative assessment methods. The diagnostic procedure is designed to identify the level of knowledge, skills, and abilities of teachers in the professional field. Quantification is based on the calculation and analysis of numerical data, such as the number of correct answers in tests and the time taken to complete them. This allows us to obtain an objective numerical indicator of the level of professional competence of teachers. Qualitative assessment includes an analysis of qualitative characteristics, such as the level of depth of understanding of the material, the ability to apply knowledge

in practice, the flexibility of thinking, and a creative approach to problem-solving. These parameters are evaluated subjectively, with the help of expert evaluation or by analyzing the quality indicators of completed tasks.

Psychological and pedagogical diagnostics includes the following methodological tools:

- general scientific method: observation, interview;
- psychological and pedagogical method: questionnaires, tests, documentation analysis, analysis;
- products of students' activities;
- socio-psychological method: sociometry, rating;
- method of mathematical statistics: methods for assessing the reliability of the shift of values feature, cluster analysis methods (Figure 2).



Figure 2 - The main points of psychodiagnostic diagnostics of experimental work on methodological support of teachers using an instrumental and methodological platform

To select questions for teachers, a modification of the "professional competence" tests was used, which allows for assessing the level of training and professional skills of teachers, as well as identifying their potential problem areas that require further training or development. The method aimed at a comprehensive assessment of these connections involves the use of various tools and tests to assess cognitive functions and activation processes. This may include tests on memory, attention, problem-solving, logical thinking, and other cognitive skills. It can also be used to measure reaction time, information processing speed, and other instrumental indicators. This method can help in making decisions about professional development opportunities, mentoring programs, and other resources that will help teachers improve their skills and knowledge.

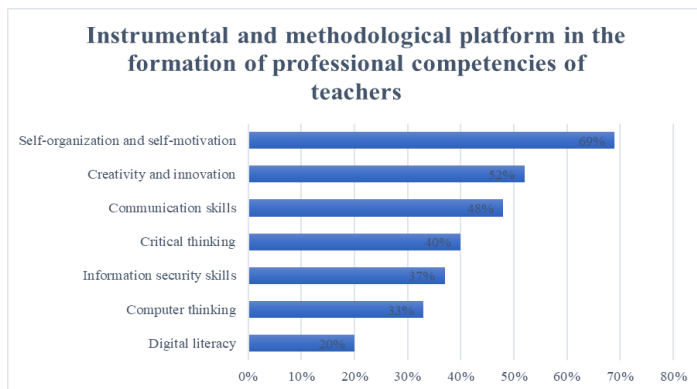


Figure 3 - Instrumental and methodological platform in the formation of professional competencies of teachers

The most important knowledge and skills that are laid down when using the instrumental and methodological platform are identified, focused on the formation of such competencies as: "Digital literacy" 20%, "Computer thinking" 33%, "Information security" 37%, "Critical thinking" 40%, and 48% - "Communication skills", "Creativity and innovation" 52%, "Self-organization and self-motivation" 69% (Figure 3).

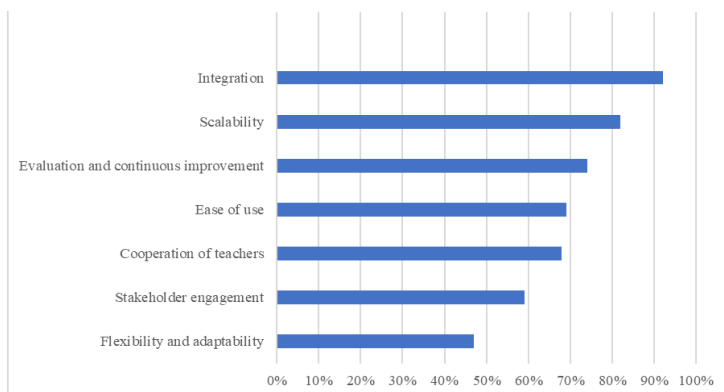


Figure 4 - The basic principles of the formation and development of the instrumental and methodological platform

The basic indicators of the components were confirmed by the professional levels determined between the control and experimental groups using an instrumental and methodological platform. During the implementation of this platform, statistical tests of data were carried out, which were used together with the multifunctional Fisher angle transformation criterion (ϕ^* Fisher criterion). This was done in order to confirm the homogeneity of the data, which is expressed in the lack of significant differences in the sample groups of KG (control group) and EG (experimental group), (Figure 4).

Results and Discussion. When discussing the formation of ICT competence of teachers, it is proposed to consider the following components: motivational-target, organizational-content, procedural-technological and evaluative-reflexive. This helps the teacher to develop the skills necessary for the effective use of ICT in the educational process (Figure 4).

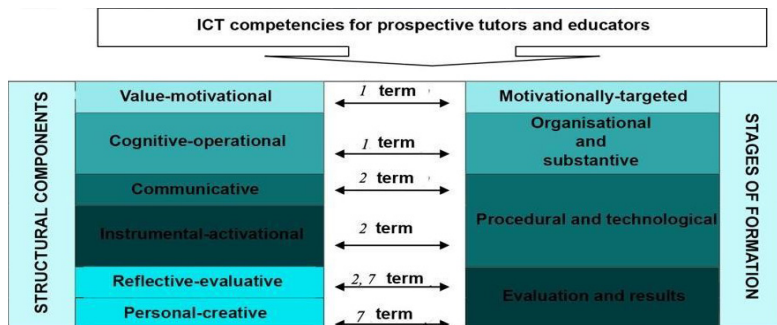


Figure 5-Comparison of the structural component of ICT competence at the stages of the formation of disciplines, according to the instrumental and methodological platform

Table 1 - Criteria for the formation of structural components of ICT competence in teachers

Structural component	Criteria of formation
1. Value–motivational	1) Awareness of the significance of ICT application and the use of the instrumental and methodological platform (IMP) in professional pedagogical activities;
2) Motivation to implement professional tasks through ICT-based tools;	
3) Compliance with network etiquette and ensuring personal data security within the IMP environment.	
2. Cognitive–operational	1) Comprehension of the nature, role, and meaning of information;
2) Skills of searching, reviewing, filtering, and selecting data, information, and educational content for the design and development of the IMP;	
3) Ability to evaluate, manage, and effectively use information, data, and educational content through the IMP.	
3. Communicative	1) Organization of interaction using ICT tools within the information and educational environment (IEE);
2) Exchange of digital tools and mediation practices in the IEE;	
3) Collaboration through ICT, including the use of the IMP, in the educational environment.	

4. Instrumental–activation	1) Creation and development of educational content using the IMP;
2) Design, improvement, and practical implementation of the IMP;	
3) Integration, updating, and refinement of educational content through the IMP.	
5. Reflexive–evaluative	1) Monitoring and assessment of individual professional progress and informational–educational materials using the IMP;
2) Evaluation of the appropriateness and effectiveness of ICT application in professional activities;	
3) Assessment of the quality and effectiveness of methodological support provided to teachers.	
6. Personal–creative	1) Innovative and creative application of ICT in professional practice;
2) Identification of individual professional needs and creative use of digital technologies with the support of the IMP;	
3) Recognition and analysis of gaps in ICT competence and directions for further professional self-development.	

The results were analyzed in the control and experimental groups during the period from 2021 to 2024. To do this, various methodological approaches and an instrumental and methodological platform were used. In the process of analyzing the results, the data obtained from the control and experimental groups were compared. The results of the analysis helped to understand the impact of the use of ICT on the educational process and to evaluate the effectiveness of the applied methodological approaches.

Table 2 shows the results of a study of the value-motivational components of teachers' ICT competence at the experimental stage. As part of the diagnosis, the main motives underlying the educational activities of teachers were identified.

Table 2 - Criteria for the formation of structural components of ICT competence in teachers

Group	Communi- cative motives	Avoidance motives	Motives of prestige	Professional motives	Motives for creative fulfilment	Educational and cognitive motives	Social motives
CG1	45	69	52	39	45	42	38
CG2	45	68	53	40	46	44	39
CG3	46	67	54	40	48	44	39
CG4	48	69	55	42	49	42	40
EG1	55	60	50	52	57	50	54
EG2	58	55	51	54	56	52	55

EG3	62	50	51	55	57	56	57
EG4	78	50	50	62	65	59	64

Based on the data in table 2, we can see how teachers' attitudes to learning have changed, taking into account the use of the platform and personal growth. It is important that the fear of failure decreased significantly in both groups (experimental and control) at the initial stage. This is probably due to the fact that teachers have adapted to the school environment by working with the platform and other resources.

At the same time, the desire for high grades has hardly changed, perhaps because formal recognition and results are important for teachers. At the same time, interest in learning and subjects (Geography and Computer Science) grew, especially in experimental groups (EG1, EG2, EG3, and EG4), where teachers learned through online courses, webinars, seminars, round tables, forums, and coaching (for example, 58% in EG4 vs. 41% in CG4).

The most important motives were communication and exchange of experience. This motive prevailed in 77% of teachers in EG4, 61% in EG3, 57% in EG2 and 54% in EG1, while in the control groups the maximum was in CG4 and did not exceed 47%. Overall, the analysis shows that teachers' motivation to use information technology has increased, but the changes were more noticeable in the experimental groups.

It is worth noting that the most difficult tasks for teachers were related to the assessment and analysis of information on the platform. These tasks had little impact on the development of information technology skills, which is explained by their complexity. They require not only knowledge, but also the ability to apply different resources in their studies. At the same time, this indicates the potential of the platform for further use. In general, teachers from the experimental groups performed better in their subjects (71% in EG4, 69% in EG3, 65% in EG2, and 63% in EG1), indicating an improvement in their information technology skills. The results of the assessment of these skills are presented in table 3.

Table 3 - Results of evaluation of the instrumental and motivational component of ICT competence of teachers at the formative stage of the experiment, %

Group	Understanding the essence and importance of educational content for the design, creation and development of an instrumental and methodological platform (IMP)	Review, search and analysis of information and educational content for the creation and development of an instrumental and methodological platform (IMP)	Assessment, management and analysis of information and educational content using an instrumental and methodological platform (IMP)	Average success %
CG1	37	45	40	41
CG2	38	45	41	41
CG3	40	46	43	43
CG4	42	48	45	45

EG1	65	66	60	64
EG2	70	67	60	66
EG3	73	70	67	70
EG4	75	72	69	72

The data in the table shows how teachers have developed information technology (ICT) skills. Overall, the results are good, especially when using our support system.

In the experimental groups, the successes are more noticeable (for example, 74% in one group versus 42% in the control group). Basically, the teachers showed an average or above average level of ICT proficiency. But the least number of teachers were able to use our platform themselves to develop their skills (68% in the experimental group and 44% in the control group). This shows that the platform can be improved. And, of course, we need to continue to study and apply it in order to help teachers master ICT.

On average, teachers performed better in the experimental groups than in the control groups (73%, 70%, 68% and 67%, respectively). This suggests that they are using ICT tools better. In table 4, you can see how teachers communicated and interacted during the learning process. We have identified three main types of behavior (Table 4).

Table 4 - The results of the assessment of the instrumental and motivational components of teachers' ICT competence at the formative stage of the experiment (in %)

Group	Dependent	Aggressive	Competent
CG1	34	9	57
CG2	32	8	60
CG3	29	9	62
CG4	30	8	62
EG1	22	8	70
EG2	20	8	72
EG3	15	7	78
EG4	15	7	78

An analysis of how the ability to communicate using ICT changes at the initial stage of the experiment suggests that teachers often behave competently. In the experimental groups, 77% of teachers showed this behavior in EG4 and EG3, 71% in EG2 and 69% in EG1. In the control groups, competent communication was most evident in CG4, where it reached 61%. This proves that teachers strive for cooperation, partnership and good interaction in the teaching environment. This is very important in order to make good use of tools and methods in education.

At the same time, aggressive behavior remained virtually unchanged and remained at a low level: 7-8% in the control groups and 6-7% in the experimental groups. This can be explained by the fact that teachers try to avoid excessive strictness, irritability, categorical judgments and negative assessments. A low

level of aggression is very important for productive work. In general, the results of the analysis of the ability to communicate using ICT show that partnership between teachers is becoming increasingly important in both experimental and control groups. This is especially important for working in a modern information environment.

Table 5 - Results of evaluation of the instrumental and motivational component of ICT competence of teachers

Group	Retrospective	Situational	Prospective
CG1	56	59	58
CG2	58	61	59
CG3	60	61	62
CG4	62	67	68
EG1	60	59	63
EG2	64	60	65
EG3	68	67	68
EG4	68	69	70

According to the data presented in the table, we can see similar levels of dynamics in various manifestations of reflexivity, and reflexive-evaluative components in the ICT competence of teachers, at the stages of formation of the SP and UP.

In general, the level of reflexivity of KG and EG increases throughout the entire training period, approaching a higher level of values of indicators. In turn, close and sometimes equal values (for example, the values for CG4 - 67% are equal to the data obtained, characteristic of EG3 - 67%) between the registered levels of reflexivity of teachers confirm minor differences between the levels of reflexivity of the compared experimental and control groups.

Diagnostics of the personal and creative component of ICT competence of teachers allowed us to determine the distribution of values on the scales of personal creativity among respondents at the stage of EW formation, presented in the table below.

Table 6 - Results of the study of the types of reflection of the reflexive-evaluative component of ICT competence, %

Group	Personal creativity diagnostic scales for future tutors and teachers, %			
	Risk appetite	Curiosity	Complexity	Imagination
CG1	55	42	25	13
CG2	56	44	27	19
CG3	58	45	27	20
CG4	60	48	30	24
EG1	67	50	33	28
EG2	68	50	35	30
EG3	70	51	36	32
EG4	72	52	36	35

In the experimental groups, the most noticeable increase in indicators was observed on the risk tolerance scale (71% in EG4 compared with 59% in CG4). This indicates that teachers strive to set goals and are ready to achieve educational results using a special platform. A positive trend was also noted on the imagination scale when evaluating personal creativity. Again, the growth was more pronounced in the experimental groups (34% in EG4, 31% in EG3, 29% in EG2, and 27% in EG1). This is due to the fact that the platform was used just for teaching teachers how to work with information. In addition, the platform helps teachers to learn independently, build personal educational routes, achieve results in different ways and find individual solutions for work tasks.

At the initial stage of the experiment, the collected data was processed statistically using the Fischer angular transformation (the ϕ^* Fischer criterion). This allows you to determine how significant the difference between the two angle values is for a given sample size. The ϕ^* criterion was used to compare the proportions of two samples in terms of the frequency of the phenomenon being studied and to assess how significant the differences between the control and experimental groups in the level of proficiency in information and communication technologies (ICT) were from the teachers. Hypotheses were formulated:

H_0 – the proportion of teachers with reproductive and productive levels of ICT proficiency in CG4 is no greater than in EG4; and H_1 – the proportion of teachers with reproductive and productive levels of ICT proficiency is higher in CG4 than in EG4.

It is worth noting that a constructive level of ICT proficiency was found in both experimental and control groups. In the CG4 control group, the constructive level was most noticeable in the components of ICT proficiency related to tools (5.0%), assessment (10.2%) and personal creativity (10.2%). At the stage of forming the experiment, the data was also processed statistically using the Fisher angular transformation (the ϕ^* Fisher criterion) so that the results were consistent and comparable.

Conclusions. In conclusion, the article summarizes the results of the study, as well as presents the main conclusions on the use of the instrumental and methodological platform:

1. An approach to informatization of teacher training for the development of ICT competence is proposed based on the use of an instrumental and methodological platform for mastering the disciplines of the computer science and geography cycle in the information and educational environment. This platform provides teachers with the opportunity to use various information and communication technologies (ICT) in the preparation and conduct of computer science and geography lessons. This set of programs, tools, and resources helps teachers create interesting lessons, develop and review assignments, and evaluate student performance. With this platform, teachers can more easily use digital technologies in teaching, such as interactive whiteboards, multimedia programs, and applications for analyzing and displaying geographical data. The use of an instrumental and methodological

platform allows teachers to effectively organize work in the classroom, share materials and resources with students, as well as provide feedback and support in the learning process. This not only improves the quality of education but also helps teachers to use their time and resources more effectively.

2. The article proves that the instrumental and methodological platform is an effective means of developing the ICT competence of teachers in information education, taking into account their personal and professional development when using its methodological functions and didactic properties: Interactivity is the possibility of interaction and exchange of information between teachers. This allows you to create an active and dynamic educational environment where each participant can demonstrate their knowledge and skills; Multimedia – the use of various multimedia materials, such as video, audio, and images, for teaching and illustrating concepts and concepts. Multimedia elements will make lessons more visual and memorable; publicity – the possibility of publishing and sharing materials, assignments, and work results between teachers and students. This allows you to create cooperation and interaction between different participants of the educational process; Non-linearity - the ability to choose the order of studying the material and performing tasks by students, depending on their individual needs and interests. This contributes to taking into account the individual characteristics of each student and adapting the educational process to his needs; Integrativity – the ability to integrate various disciplines and courses, which allows you to create comprehensive and related educational programs. This helps students to see the connections between different subject areas and apply their knowledge in different situations.

3. A model of the formation of ICT competence of teachers in the conditions of informatization has been developed and substantiated. Formation of ICT competence of teachers is an important task in the conditions of modernization (informatization) of education. The model developed for this purpose should be justified taking into account modern requirements and trends in the field of information and communication technologies. One of the main components of the model of formation of ICT competence of teachers is training. This can be both formal education (courses, training, master classes) and informal training (self-education, exchange of experience with colleagues). Training should include not only the development of specific ICT skills but also the development of pedagogical competencies that allow the effective use of information technology in the educational process. Support from the school or educational institution administration also plays an important role in the model. The administration should provide access to the necessary ICT resources and infrastructure, as well as create conditions for the exchange of experience and cooperation between teachers. In addition, the administration should support the initiatives of teachers aimed at introducing innovative ICT solutions. Another component of the model is the constant self-development of the teacher. Information technology is constantly evolving, and the teacher should be ready to be aware of the latest trends and update their knowledge

and skills. It is also important to develop a teacher's conscious attitude to ICT competence and the ability to self-assess so that he can systematically analyze his strengths and weaknesses and work on their improvement. Finally, the model should take into account the context and specifics of the educational institution. Each school or educational institution has its characteristics, and the introduction of ICT should be adapted to these characteristics. The model should contain flexibility and the ability to adapt to changes that may occur in the organization.

4. A platform has been developed and implemented to provide methodological support for the formation of ICT competence of teachers in the context of the implementation of the proposed approach to informatization of its formation, including work programs of disciplines, electronic educational and methodological support for their implementation, a set of educational and methodological materials that provide all types of educational activities. This is a significant step in the development of informatization of education. The presented methodological platform is a comprehensive solution that includes several components. Working programs of disciplines help to structure the educational process and determine the main goals and objectives of teacher training. They are an important tool for planning and evaluating the learning process. Electronic educational and methodological support allows teachers to access digital resources, materials, and tools for teaching. It provides teachers with the opportunity to use modern technologies and techniques in their work, making the learning process more interactive and effective. The set of teaching materials provided on the platform is a valuable source material for teachers. These materials include textbooks, lesson summaries, assignments, and examples of work that help teachers develop lessons, conduct practical classes, and evaluate students' academic achievements. The platform offers comprehensive support to teachers in the formation of ICT competence. It not only provides the necessary educational content but also creates conditions for the development of key skills and abilities of teachers in the field of information technology. By using this platform, teachers will be able to become more confident and competent in using ICT in their teaching practice. This, in turn, will help them teach more effectively, create interesting and interactive lessons, and also improve the educational process as a whole.

5. The effectiveness of the formation of ICT competence in the implementation of the proposed approach to informatization of education, taking into account the developed methodological support, is proved. Significant positive changes in the level of formation of ICT competence of teachers in experimental groups allow us to confirm the hypothesis and solve research tasks. These results mean that the proposed approach to informatization of education and the developed methodological support have a significant impact on the formation of ICT competence of teachers. This may be especially important in the modern information society, where the use of information and communication technologies is becoming increasingly necessary in the educational environment. Research is a valuable research contribution and

can serve as a basis for further development and improvement of approaches to the formation of ICT competence of teachers. This also confirms the importance and usefulness of the methodological support that was developed during the research process.

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