*KazNPU imeni Abaya. Seriya: Pedagogicheskie nauki,* 2025, vol. 85, no. 1, pp. 376-387. https://doi.org/10.51889/2959-5762.2025.85.1.035. (in Russian)

13 **Committee on the Rights of Persons with Disabilities.** Concluding observations on the initial report of Kazakhstan (CRPD/C/KAZ/CO/1). New York, UN, 2024. Available at: https://tbinternet.ohchr.org/_layouts/15/treatybodyexternal/Download.aspx?symbolno=CRPD%2FC%2FKAZ%2FCO%2F1&Lang=en (accessed 15.04.2025).

14 **Stambekova A., Karmenova M., Aitbayeva A., Kuterbekova A. The model of pre-university training of people with disabilities in the system of inclusive higher education**. *World Journal on Educational Technology: Current Issues*, 2022, vol. 14, no. 3, pp. 711-722. http://dx.doi.org/10.18844/wjet.v14i3.7274.

15 **Cabbeh K. D., Villafuerte B. J. A., Ruiz J. K. O., Adanza J. R. Lived Experiences of Parents of Children with Intellectual Disability Undergoing Pre-Vocational Education.** DLSU Research Congress 2015: conference proceedings, Manila, Philippines, March 2-4, 2015. Manila, De La Salle University, 2015. Available at: URL:https://www.dlsu.edu.ph/wp-content/uploads/pdf/conferences/research-congress-proceedings/2015/LLI/009LLI_Cabbeh_KD.pdf (accessed 15.04.2025).

16 **Wehman, P. Best Practices in Transition to Adult Life for Youth With Intellectual Disabilities** 2015, September. Available at: https://www.researchgate.net/publication/280770619_-Best_Practices_in_Transition_to_Adult_Life_for_Youth_With_Intellectual_Disabilities (accessed 15.04.2025).

**Сведения об авторах:**

*Жигитов Алибек Бекежанович* – PhD докторант, кафедра специальной педагогики, Казахский национальный педагогический университет им. Абая, Республика Казахстан, 050010 г. Алматы, пр. Достык 13, тел.: +7-707-367-89-85, e-mail: zhigitov_ali@list.ru.*

*Алимбаев Алибек Алпыспаевич – PhD, и.о. ассистента профессора кафедры физики, математики и цифровых технологий, Костанайский региональный университет имени Ахмет Байтұрсынұлы, Республика Казахстан, 110000 г. Костанай, ул. Пушкина 204/1, тел.: +7-708-697-85-99, e-mail: alialimbayev@gmail.com.*

*Жигитов Алибек Бекежанович* – PhD докторанты, Арнайы педагогика кафедрасы, Абай атындағы Қазақ ұлттық педагогикалық университеті, Қазақстан Республикасы, 050010 Алматы қ, Достық даңғ. 13, тел.: +7-707-367-89-85, e-mail: zhigitov_ali@list.ru.*

*Алимбаев Алибек Алпыспаевич – PhD, Физика, математика және цифрлық технологиялар кафедрасының профессоры ассистентінің м.а., Ахмет Байтұрсынұлы атындағы Қостанай өңірлік университеті, Қазақстан Республикасы, 110000 Қостанай қ., Пушкин көш. 204/1, тел.: +7-708-697-85-99, e-mail: alialimbayev@gmail.com.*

*Zhigitov Alibek Bekezhanovich* – PhD student, Department of Special Pedagogy, Abai Kazakh National Pedagogical University, Institute of Pedagogy and Psychology, Republic of Kazakhstan, 050010 Almaty, 13 Dostyk ave., tel.: +7-707-367-89-85, e-mail: zhigitov_ali@list.ru.*

*Alimbayev Alibek Alpysbayevich – PhD, Acting Assistant Professor of the Department of Physics, Mathematics and Digital Technologies, Akhmet Baitursynuly Kostanay Regional University, Republic of Kazakhstan, 110000 Kostanay, 204/1 Pushkin Str., tel.: +7-708-697-85-99, e-mail: alialimbayev@gmail.com.*

IRSTI 14.35.07
UDC 378.147
https://doi.org/10.52269/RWEP2522100

## DEVELOPMENT OF RESEARCH COMPETENCE IN FUTURE PHYSICS TEACHERS DURING THEIR UNIVERSITY STUDIES

*Zhunussova R.A.* – PhD student, Senior Lecturer of the Higher School of Natural Sciences, Alkey Margulan Pavlodar Pedagogical University, Pavlodar, Republic of Kazakhstan.*

*Seitkhanova A.K. – PhD, Associate Professor of the Higher School of Natural Sciences, Alkey Margulan Pavlodar Pedagogical University, Pavlodar, Republic of Kazakhstan.*

*Dakhin A.N. – Doctor of Pedagogical Sciences, Professor, Novosibirsk State Pedagogical University, Novosibirsk, Russian Federation.*

*The article presents the results of the study of the problem of training physics students for inquiry-based learning. It outlines a stage-based approach for developing research skills and abilities in future teachers within the framework of higher education. The article is based on the extensive empirical data analyzed using methods of mathematical statistics. The study relevance stems from the growing need to*

*develop research skills in the future educators and to train them in effective organization of the student research activities at the school level. This task is unattainable without the formation of strong research competencies in the teachers themselves, as these skills are a key indicator of professional readiness. A teacher must not only facilitate student engagement in project-based and investigative learning but also possess a sound understanding of the general principles of research. Key indicators of research competence in future teachers include the ability to navigate educational contexts, formulate research plans, design and implement creative tasks both at school and at home, enhance students' understanding of physics, and foster their research skills. The focus lies not solely on acquiring knowledge, but on the development of the capacity to independently set educational objectives, plan strategies for their achievement, monitor progress, and evaluate outcomes. The study was conducted at the Alkey Margulan Pavlodar Pedagogical University.*

***Key words:*** *diagnostics, future physics teacher, research activity, research competencies, competency development, methods of teaching physics.*

## ЖОО-НЫҢ ОҚУ ҮРДІСІНДЕ БОЛАШАҚ ФИЗИКА МҰҒАЛІМДЕРІНІҢ ЗЕРТТЕУШІЛІК ҚҰЗЫРЕТТІЛІКТЕРІН ҚАЛЫПТАСТЫРУ

*Жунусова Р.А.* – PhD докторанты, жаратылыстану жоғары мектебінің аға оқытушысы, Әлкей Марғұлан атындағы Павлодар педагогикалық университеті, Павлодар қ., Қазақстан Республикасы.*

*Сейтханова А.К. – PhD, жаратылыстану жоғары мектебінің қауымдастырылған профессоры, Әлкей Марғұлан атындағы Павлодар педагогикалық университеті, Павлодар қ., Қазақстан Республикасы.*

*Дахин А.Н. – педагогика ғылымдарының докторы, профессор, Новосібір мемлекеттік педагогикалық университеті, Новосібір қ., Ресей Федерациясы.*

*Мақалада физика студенттерін ғылыми-зерттеу жұмыстарына дайындау бойынша жүргізілген зерттеу нәтижелері берілген. Онда болашақ мұғалімдердің жоғары оқу орнында оқу процесінде зерттеушілік дағдыларын дамытудың кезеңдік жоспары қарастырылған. Мақалада математикалық статистика әдістерімен өңделген эмпирикалық деректердің үлкен көлемі қамтылған. Зерттеу тақырыбының өзектілігі – болашақ мұғалімдердің зерттеушілік қабілеттерін дамыту, оларды мектеп оқушыларымен зерттеу жұмыстарын ұйымдастыруға дайындау мәселесі. Бұл болашақ мұғалімнің зерттеушілік дағдыларын қалыптастырмай мүмкін емес, себебі олар оның кәсіби деңгейінің маңызды көрсеткіші болып табылады. Мұғалім ең алдымен оқушылардың жобалық-зерттеу қызметін басқара білуі керек және зерттеу қызметінің жалпы заңдылықтарын меңгеруі қажет. Болашақ мұғалімдердің зерттеушілік дағдыларын дамытудың негізгі белгілері, біздің ойымызша, оқу жағдаяттарын бағдарлай білу болуы керек; зерттеу жоспарын құру; шығармашылық сабақты және үйдегі зерттеу тапсырмаларын ұйымдастыру және өткізу; оқушылардың физика пәнінен білім деңгейін арттыру және зерттеушілік дағдыларын дамыту. Бұл жай ғана білімді меңгеру емес, өз бетінше оқу мақсаттарын қою, оны жүзеге асыру жолдарын жобалау, өз жетістіктерін бақылау және бағалау, қорытынды жасау және нәтижелерді талдау дағдыларын дамыту. Зерттеу Әлкей Марғұлан атындағы Павлодар педагогикалық университетінің базасында жүргізілді.*

***Түйінді сөздер:*** *диагностика, болашақ физика мұғалімі, зерттеушілік іс-әрекет, зерттеушілік құзыреттіліктер, құзыреттілік қалыптастыру, физиканы оқыту әдістері.*

## ФОРМИРОВАНИЕ ИССЛЕДОВАТЕЛЬСКИХ КОМПЕТЕНЦИИ У БУДУЩИХ УЧИТЕЛЕЙ ФИЗИКИ В ПРОЦЕССЕ ОБУЧЕНИЯ В ВУЗЕ

*Жунусова Р.А.* – PhD докторант, старший преподаватель высшей школы естествознания, Павлодарский педагогический университет имени Әлкей Марғұлан, г. Павлодар, Республика Казахстан.*

*Сейтханова А.К. – PhD, ассоцированный профессор высшей школы естествознания, Павлодарский педагогический университет имени Әлкей Марғұлан, г. Павлодар, Республика Казахстан.*

*Дахин А.Н. – доктор педагогических наук, профессор, Новосибирский государственный педагогический университет, г. Новосибирск, Российская Федерация.*

*В статье изложены результаты исследования проблемы подготовки студентов-физиков к исследовательскому обучению. В ней дается поэтапный план формирования исследовательских умений и навыков будущих педагогов в процессе обучения в ВУЗе. Статья содержит большой объем эмпирических данных, которые обработаны при помощи методов математической статистики. Актуальностью темы исследования является проблема развития исследовательских способностей будущих учителей, подготовка их к организации исследовательской деятельности со школьниками. Это не представляется возможным без формирования исследовательских умений будущего учителя, которые выступают важным показателем его профессионального уровня,*

*так как учитель в первую очередь должен уметь руководить проектно-исследовательской деятельностью школьников и при этом знать общие закономерностей исследовательской деятельности. Основными признаками сформированности исследовательских умений у будущих учителей должны, по нашему мнению, стать умения ориентироваться в учебных ситуациях; строить план исследования; организации и проведения творческих поурочных и домашних исследовательских заданий; повышение уровня знаний у учащихся по физике и формирование исследовательских навыков. Это не просто овладение знаниями, а развитие умений самостоятельно ставить учебные цели, проектировать пути их реализации, контролировать и оценивать свои достижения, делать выводы и анализировать результаты. Исследование проводилось на базе Павлодарского педагогического университета имени Әлкей Марғұлан.*

***Ключевые слова:*** *диагностика, будущий учитель физики, исследовательская деятельность, исследовательские компетенции, формирование компетентности, методы обучения физике*.

**Introduction.** Currently, in the Republic of Kazakhstan the main directions of modern development of education both at school and at HEI are defined. The relevance of the research topic is the problem of training future physics teachers to organize research activities of schoolchildren, the need to develop the research abilities of future physics teachers as an important factor in their professional development [1, p.37]. The relevance is also confirmed by the presence of many studies on this topic, which show that physics teachers and future teachers (students of pedagogical HEIs) have insufficient readiness to form students' research skills while studying physics, the structure of research experience is not defined, relationships and connections of research skills in various academic disciplines are not established [2-4]. The motivations for teaching students of pedagogical universities are also considered by foreign scientists S.M. Ketko [5-8], AMS method [9, p.1003].

There are scales to measure students' academic motivation [10-14].

The formation of future physics teachers research competence is a controlled and guided process, which begins within the HEI walls under the guidance of experienced teachers. It is necessary to train specialists at the HEI who have research skills and abilities and can use it in their pedagogical work. The students' research competence is an important factor in the training young professionals and scientists. The student acquires skills that will be beneficial to them throughout their life, no matter what fields they work in: independence of judgment, the ability to concentrate, to constantly enrich their own store of knowledge, to have a multifaceted view of emerging problems, just to be able to work purposefully and thoughtfully.

Actualization of the above theoretical information allows us to address the modeling of the overall process of formation of students' readiness to implement a research approach to learning, considering it as a pedagogical process.

The main most effective organizational forms of students' research activities are: academic and research work on curricula; inclusion of elements of research work in the classroom; laboratory work; performance and defense of course works and graduation theses with research sections or entirely research nature; individual research work of students, that is, their participation in the development of a particular problem under the guidance of a faculty particular researcher supervisor; pedagogical practice; preparation of a scientific structural abstract on a given topic; Students' Scientific Circle; obtaining patents and certificates of authorship by students; student science teams on problems, laboratories and other creative associations; involving students in research projects funded from various sources (state budget, contracts, grants, etc.); participation in scientific workshops, conferences, competitions for scientific and educational and research work of students, Olympiads in disciplines and specialties, etc.

**Goal and objectives.**

Research goal: Formation of research skills and abilities in future physics teachers during their professional training at a higher education institution, ensuring their readiness to organize research activities for school students.

To reach the goal, the following objectives are set:

1. To analyze theoretical approaches to the problem of forming research competence in future physics teachers.

2. To implement a step-by-step program for the development of research skills in the educational process of the university.

3. To conduct a diagnostic study of the level of research skills formation among students and evaluate the effectiveness of the proposed model and pedagogical conditions.

**Materials and methods.** Higher education institutions face the challenge of creating conditions that promote research skills and abilities formation.

During our research the effectiveness of using staged formation of future teachers training competence to implement a research approach to learning was determined and evidence based.

The proposed plan provides for a staged formation of research competencies in future physics teachers. Each of the stages requires the formation of the required professional qualities and depends on the corresponding didactic tasks set. Organizationally it is possible if the future physics teacher's training for

research activity has a staged plan. Stage I (general basic training) – within the study of basic disciplines of the HEI component of such disciplines as “Physics Teaching Techniques”, “Distant Learning Technologies”, “Inclusive Education”, “Basics of Research Activities and Academic Writing”, “Physical Experiment”, "Optics" etc. and elective methodical courses; Stage II (stage of profile training) – during educational/pedagogical, psychological and pedagogical practice at school; Stage III (stage of individual training) – organization of work with individual students in preparing course works and graduate qualification works, Stage IV (stage of extracurricular training) – scientific-research work conducted during extracurricular time (participation in scientific work of the department, participation and speaking at scientific conferences, workshops, competitions, etc.) Thus, this model has a person-centered character, because the student (future physics teacher) is a subject of learning and own development. Let us note that research competences of generalized nature are formed continuously throughout all the stages of training described above.

Stage 1 (general basic training) – within the study of basic disciplines of the HEI component such disciplines as “Physics Teaching Techniques”, “Distant Learning Technologies”, “Inclusive Education”, “Basics of Research Activities and Academic Writing”, “Physical Experiment”, etc. and elective methodical courses:

- At lectures (ability to work with literature, ability to analyze information, draw conclusions; logically comprehend material, highlighting the main thing in it; correlate, compare facts; compare and generalize new facts and phenomena; make comparison with already known data;
- In the practical classes (ability to analyze literature, compare, systematize pedagogical facts and phenomena; see, understand and explain the content, causes and consequences, the process of pedagogical phenomenon emergence and development);
- On independent work (ability to make a convincing argument for conclusions, to draw his/her own conclusions, collect and summarize materials, participate in discussions and draw conclusions, participate in conducting a mini-research; summarize materials in the form of a report or a structural abstract).

An important principle of comprehensive work on the research competence formation is the continuity of its methods and forms from course to course, from department to department, from one discipline to another, from one type of classes and assignments to another. At the same time, it is necessary that the complexity and volume of knowledge, skills and abilities acquired by students in the process of carrying out their research work increased gradually. For example, at the stage, the goal and the main content of all work was the formation during general scientific training of students’ promising skills, abilities and acquisition of the simplest knowledge necessary to perform scientific work, teaching the basics of independent work, the development of non-standard thinking. Abstract work and scientific research within laboratory works can be useful here. At the second stage during the performance of small independent research and creative assignments there is the formation of special research skills, deepening knowledge of methods, techniques, technical means of research and processing of results. Assignments and forms of research work become more complicated, their volume increases.

Stage II (stage of profile training) – during educational/pedagogical, psychological and pedagogical practice at school (ability to observe pedagogical phenomena, collect and process statistical observation data; implement the results in practical activity; study and generalize the experience of teachers; use variant methods; conduct an experiment and evaluate its results; summarize materials obtained during work with children, using various research methods in the form of a report; evaluate the level of their professional abilities development and make a plan for further professional development.

Stage III (stage of individual training) – organization of work with individual students in preparing course works and graduate qualification works. Course work is an independent academic work of HEI students, carried out for research skills and abilities development. It contributes to the deepening of theoretical and practical knowledge in the field of pedagogy and physics, the development of research skills and abilities. Students demonstrate the ability to: set goals and objectives; work with literature and analyze information; show theoretical training in physics; competently state the present of the issue under study based on its analysis; perform experimental work, process the empiric material obtained, analyze, systematize, interpret it and draw conclusions. Thus, the integration of the above activities helps students connect theory with practice, feel themselves in the role of the researcher, check their capabilities and propensity to the future profession, fosters confidence in themselves, their knowledge, makes them work on themselves to deepen their knowledge and skills and promotes professional competence. Writing theses in pedagogical institutes is directed to improvement of future teachers’ professional preparation and is connected with profound studying of the theory, bringing in system and replenishment of earlier acquired knowledge, formation and development of skills of independent research activity, increase of erudition of students.

Stage IV (stage of extracurricular training) – scientific – research work conducted during extracurricular time (participation in scientific work of the department, participation and speaking at scientific conferences, workshops, competitions, etc.). The teacher engages the student more in independent search, his/her task becomes to create conditions for their initiative. Teachers can conduct thematic classes or organize creative groups when working on an academic project; form a student’s portfolio. Students can help teachers to create learning resources; departmental educational and methodical complexes (courses of lectures, training materials, thesis, creative works, audio and video materials, etc.).

The research involved 36 students of II and III, IV courses of “Physics”, “Physics and Mathematics” at Pavlodar Pedagogical University.

Despite the limited sample size (36 students), several measures were taken to enhance the reliability and validity of the findings. Participants were selected based on strict criteria, ensuring group homogeneity and minimizing the influence of extraneous factors. Validated and reliable measurement instruments appropriate to the research objectives were employed. To account for the characteristics of a small sample, statistical methods robust to deviations from normality were applied, including nonparametric tests and the calculation of confidence intervals.

Additionally, the results were cross-validated through repeated measurements and data triangulation, contributing to increased internal reliability. Particular attention was given to controlling potential sources of systematic error, including minimizing experimenter effects and participant bias

We will consider Stage I on formation of research competence in future physics teachers. Within the framework of studying basic disciplines of the HEI component such disciplines as “Physics Teaching Techniques”, “Distant Learning Technologies”, “Inclusive Education”, “Basics of Research Activities and Academic Writing”, “Physical Experiment”, "Optics" etc. and elective methodical courses not only ensure the quality of mastering subject knowledge by students, but also develop research and communicative competences. A favorable communicative environment was formed in classes based on creative activity in parallel with the work on the direct class assignment: the development of rules of cooperation, which contributed to the search for a common solution: problems were discussed and analyzed in joint work. Presentations were made and after each session there was a reflection. The students shared their impressions, expressed their opinion on the organization of the next class. The students showed interest, activity, curiosity.

The following methods of formation of research competence were used: a method of observation, a method of comparative analysis, a method of experiment, brainstorming, etc.

While observing the students in the classes and analyzing their written creative works, we determined the levels (high, sufficient, threshold, low, critical) of skills development.

*Table 1* – Levels, criterion of readiness components, as well as scores for determining numerical indicators.

| Level | Criterion | | | | |
|---|---|---|---|---|---|
| | Motivational | Content-related and | Creative | Reflective | Score |
| High | M) Performs willingly, understands its significance and the value of the result obtained. Demonstrates activity and initiative | S) Can independently search, retrieve and select information. Can systematize and analyze necessary information to solve assigned tasks | K) Proposes his/her own hypotheses, ideas, methods of problem solving; Develops creative abilities, design and modeling abilities. | R) be able to independently search for errors. be able to completely eliminate errors and deficiencies | 4, 6-5 |
| Sufficient | M) Has a general idea of innovative activities Has skills in generalized ways of performing design activities | S) He/she is able to work with different sources of information. Solves typical problems | K) be able to select methods related to the search for the necessary solution options. Difficulty in some cases | R) Does not show the desire for self-development and self-improvement; Not always an adequate assessment of his/her own activities | 4,1-4,5 |
| Threshold | M) Understands the importance of innovative activities, has a superficial knowledge of the theoretical basis of research activities | S) The ability to work with information is demonstrated in the activity at a sufficient level. Demonstrates fragmented knowledge | K) Demonstrates knowledge only in standard conditions Demonstrates skills only in standard conditions | R) be able to independently identify existing shortcomings in the research being conducted, but has difficulty in correcting them. Be aware of the significance of the result | 3,1-4 |

*Continuation of table 1*

| | | | | | |
|---|---|---|---|---|---|
| Low | M) Does not show interest. Low level of cognitive motivation | S) Insufficient knowledge of the subject | K) Not particularly interested in coming up with his/her own ideas. Has minimal experience in conducting an experiment | R) Plans and works under the guidance of a teacher. Able to work only in a group | 2,1-3 |
| Critical | M) Lack of interest. Non-formed cognitive motives of research activity | S) Does not know basic research concepts. Does not know how to use research skills, has significant difficulty with the choice of research methods | K) Lack of ideas, plans, hypotheses. Does not show creativity at all | R) Cannot independently identify shortcomings or inaccuracies in the study being conducted, much less correct them Does not understand the essence of the work | 1-2 |

The obtained values of the readiness component indicators for each student were converted into readiness scores with a maximum score of 5 and a minimum score of 1.

The average value of all readiness indicators for each student was determined as per the following formula:

$$X = \frac{M + S + K + R}{4}$$

where

X – average value of the readiness indicators for research activity;

M – value of the indicator of motivational component of readiness (professional and cognitive motivation);

S – value of the indicator of the content-related component of readiness (knowledge of the essence of physical phenomena and processes; ability to solve typical problems);

K – value of the indicator of creative component of readiness (innovative approach to problem solving; ideas of design, hypotheses, etc.);

R – value of an indicator of the reflexive component of readiness (ability to adequate self-assessment and self-analysis).

At the beginning of the study, the results analysis showed that the level of development of research skills and abilities has low indicators – threshold and low scores prevail. Students have a low level of the reflexive component. At the final stage of the study there was repeated diagnostics of the level of development of research skills and abilities of students with the help of the same technique.

We will conduct a statistical analysis using the Wilcoxon t-test and determine whether there is an intense shift in the indicators in this direction.

$H_0$: Post-experiment scores are higher than pre-experiment scores. $H_1$: Post-experiment scores are less than pre-experiment scores.

The sum of the ranks column is equal to ∑=666. Checking the correctness of the matrix based on checksum calculation:

$$\sum x_{ij} = \frac{(1+n)n}{2} = \frac{(1+36)36}{2} = 666$$

The column sum and the checksum are equal, so the ranking is correct. Now let us mark the directions that are atypical, in this case, negative. The sum of the ranks of these “rare” directions is the empirical value of the criterion T: T=∑Rt=26+26=52

We use the table to find the critical values for the Wilcoxon T-criterion for n=36: $T_{cr}$=185 (p≤0.01). $T_{cr}$=227 (p≤0.05). The zone of significance in this case extends to the left; indeed, if there were no “rare”, in this case positive, directions at all, then the sum of their ranks would be zero. In this case, however, the empirical value of T falls into the zone of significance: $T_{emp}<T_{cr}$(0.01). Hypothesis $H_0$ is accepted. Post-experiment indicators exceed the values of pre-experiment indicators.

There is a statistically significant positive shift: the indicators of the research skills development level at the final stage have increased in comparison with the same indicators at the first ascertaining stage.

**Results and discussion.** Experimental-pedagogical work on the development of research competence while studying the disciplines “Physics Teaching Techniques”, “Distant Learning Technologies”, “Inclusive Education”, “Basics of Research Activities and Academic Writing” “Physical Experiment” etc. and

elective methodical courses had a positive result. Thus, the results obtained in a small sample population are reliable. These results can be extended to the entire general population of students, and methodological recommendations can be given.

We move (куда сдвинули?) Stage II of the formation of research competence of future physics teachers during educational-pedagogical and psychological-pedagogical practice at school.

Pedagogical practice serves as a continuation of formation of skills of this work in communication with children. Interns – students were in practice at schools. In practice they applied knowledge and skills received at the first stage. Methods of supervision, game, trainings were applied, for which they had to prepare seriously, to find interesting topics based on scientific and cognitive literature analysis.

During the practice students conduct empirical research, study the experience of teachers, prepare and conduct brain-building games, study and analyze the documentation of the educational institution. That makes a significant contribution to their research skills development.

During the internship students collect materials for their thesis. After the internship students submit a report on the internship. After the survey it was found that during the practice 20% of students gathered materials for graduation qualification work completely, 60% – partially, and 20% of students had no empirical material.

The results of the formation of research competence in stage II have already been described in detail in a scientific article [15, p.367].

Stage III (stage of individual training) – formation of research competence in course works and graduation qualification works. Writing course works is one of the most important types of research activities, which affects the development of research skills of students.

Course work contributes to the deepening of theoretical and practical knowledge in the field of physics and physics teaching technique, the development of research skills and abilities. In preparing course work students should be able to identify the problem; work with scientific literature; own the conceptual and research vocabulary; show appropriate theoretical training; knowledge of the main current problems of physics teaching techniques; ability to determine methods of problem solving, select and conduct techniques of scientific and psychological research (experiment, psychological diagnosis, testing, etc.); be able to process, analyze and interpret the empirical data obtained, evaluate and prove the effectiveness of training or psychological correction; be able to formulate conclusions and recommendations; and be able to conduct a discussion in defense of an educational and scientific work.

Thus, any term paper should be an individual, completed work, reflecting the interests of the student, his knowledge, skills and abilities, it acts as a form of his/her exposure to the specifics of theoretical scientific work. In view of the above, our study has planned and conducted a series of measures to update, deepen and expand research work technique with students during their course works preparation.

We analyzed the topics of course works and carried out questioning of students in order to identify the difficulties they meet when writing course work. Methodological guidelines for course work were written based on survey results and consultations on the topic “Identifying differences in the level of the studied attribute using Wilcoxon T-criterion” were conducted, “Finding correlation relationships using Spearman’s rs-criterion”. The content of classes included questions that cause difficulties for students.

To solve the problem of diagnosing research skills during course work preparation, we applied the technique of determining the level of development of thinking processes and creative abilities of students themselves. We used “Diagnostics of verbal and non-verbal creativity (J. Guilford and P. Torrance modified by E. Tunick)” [16, p.50]. This test is aimed at detecting creative thinking. The following factors are investigated: fluency (characterizes fluency of creative thinking determined by the total number of answers); flexibility of creative thinking i.e., ability to switch quickly determined by the number of answers; originality (ability to find an unusual approach to problem solving determined by the total number of answers); accuracy (characterizes logical, adequate solution).

As a result of the analysis of the diagnostics performed, the total accuracy index for all categories was revealed. We have the following indexes: critical index – 5%; low index of accuracy was revealed in 10%, threshold index – 35%, sufficient index – in 38% of examinees, high index – in 12% of examinees. As we see in the analysis of all the conducted diagnostics gaps allow us to state that there is a need for targeted work on the formation of research competence of future teachers to develop creative abilities.

Writing and defending a graduate qualification work is the final stage of the final certification of university graduates and determines the level of specialist’s readiness to solve theoretical and practical problems of research nature. At this stage, students demonstrate their research skills and abilities, such as the ability to work with scientific literature, find the necessary information, the ability to put forward hypotheses, to see the problems. The degree of students’ research skills and abilities is at a sufficiently high level, and students actively use them, applying them in their research and in learning activities. We found out through questioning that most of the students (60%) chose the topic of their thesis themselves, that is, they are interested in their work, they have research preferences. When asked if the theme of their thesis was related to the themes of their previous course work, 65% of students answered positively, this indicates that most students are passionate about a single problem and have been conducting their research work in this direction for several

years. At the time of the survey most students had started working on the practical part (54%), were at the stage of collecting information (44%), and some even had work at the stage of completion (2%).

Thesis is one of the important and promising types of research activities. In creative interaction of a student and a teacher the personality of a future specialist is formed, the ability to solve urgent problems, to independently navigate in scientific and special literature, to successfully apply theoretical knowledge in practice is developed. After the thesis students are involved in the process of improving previously acquired research skills and abilities.

At Stage IV (stage of extracurricular training) – organization of student research activities in the framework of SSRP (Student Scientific Research Project) – clubs (subject, problem), student scientific conferences, as well as mass-organized activities (annual pedagogical Olympiads, pedagogical CFI (Club of the Funny and Inventive), competitions of visual aids for pedagogical practice, competitions for the best course work or thesis.

This stage should be ensured by the continuous participation of students in scientific work during the whole period of study. An important principle of this stage is the continuity of its techniques and forms from course to course, from faculty to faculty, from one discipline to another, from one type of training lessons and assignments to another. At the same time, it is necessary that the complexity and volume of knowledge, skills and abilities acquired by students in the process of their research work increased gradually. For example, in the first and second years, the aim and the main content of all work should be the formation during general scientific training of students' promising skills, abilities and acquisition of the simplest knowledge necessary to perform scientific work, teaching the basics of independent work, the development of non-standard thinking. Here can be useful abstract work and scientific research in the framework of laboratory works. In the third year during small independent research and creative tasks there is the formation of special research skills, deepening knowledge of methods, techniques, technical means of research and processing of results. At this stage it should be mandatory to participate in intramural conferences, competitions of scientific works. Assignments and forms of research work become more complicated, their volume increases. Work is becoming of more and more pronounced creative nature. On the fourth and especially on the fifth year further formation, consolidation and improvement of knowledge, abilities and skills, the development of creative thinking and approach to solving specific problems, the ability to make and implement decisions independently, the use of acquired knowledge in practice should take place mainly in the process of independent research work of students on individual assignments. Therefore, it is necessary to participate in conferences, competitions of all levels, conduct scientific research under the guidance of university staff, participate in the competition of thesis, grant competitions. Research work of students is completed with the obligatory presentation of the report, presentation at the meeting of the circle, conference, writing a course work, etc.

Students' research work is an important factor in preparing a young professional and scholar. The student acquires skills that will be beneficial to them throughout their life, no matter what fields they work in: independence of judgment, the ability to concentrate, to constantly enrich their own stock of knowledge, to have a multifaceted view of emerging issues, just to be able to work purposefully and thoughtfully.

All of these types of work directly affect the development of students' research skills and abilities. From the above it can be concluded that the institute actively carries out work aimed at the development of students' research skills.

One of the key aspects that requires further development is the emphasis on interdisciplinary integration in the formation of students' research competence. The presented material focuses on describing individual disciplines, while successful development of research skills requires the synthesis of knowledge from various fields, which ensures a deeper understanding of the issues and promotes the development of systemic thinking. Incorporating this aspect would significantly enhance the scientific validity and practical value of the proposed model.

To implement interdisciplinary integration, we are developing interdisciplinary courses and seminars that bring together various areas of knowledge and provide students with the opportunity to apply approaches from different disciplines when solving complex problems. We are also introducing project-based work, where students engage in research that requires combining knowledge from several subject areas. Furthermore, we actively use methods focused on analysis and synthesis of information, such as case studies and problem-based learning, which help develop skills in interdisciplinary analysis. Additionally, we are organizing joint sessions and discussions where professors from different disciplines exchange experiences and coordinate the educational process to achieve the maximum effect from interdisciplinary integration.

These measures will allow us to fully unlock the potential of integrating various disciplines, ensuring a more comprehensive development of students' research competence and enhancing the scientific value of research projects.

**Conclusions.** During the research at Pavlodar Pedagogical University, the effectiveness of using a staged plan to form the research competence of future teachers to implement a research approach to learning was determined and empirically proved. Summarizing the above, we can distinguish two directions in the studied training: academic-research activities and scientific-research activities of students. The curricula of pedagogical universities provide for students' academic-research activities (development of

problem questions on the studied topics of psychological and pedagogical disciplines, writing structural abstracts, course works, graduate qualification papers, etc.) and scientific-research activities (participation in the work of problem groups under the guidance of a teacher, in development of problem questions in faculties, in research laboratories, etc.). In connection with the purposeful preparation of future teachers to supervise schoolchildren's research works it is necessary to create conditions for their independent research: to help in choosing the topic, the place of the experimental part of the research, to provide the student with the necessary instructional materials of advisory nature, diagnostic tools. Also, to develop research skills and abilities students need to participate in conferences, readings, competitions at all levels (thesis competition, grant competitions). Currently, the problem of involving students in scientific-research and academic-research activities is, as noted above, quite urgent. In these types of activities there is formation of key research skills and abilities necessary for successful professional activity of a future educational psychologist and his/her self-development. Concluding the discussion on the problem of training students to implement a research approach to learning, we would like to emphasize that its effective implementation is possible only with the joint efforts of both students and teachers.

**REFERENCES:**

1. **Andreeva O.S., Selivanova O.A., Vasileva I.V. Kompleksnaya diagnostika komponentov issledovatel'skoj kompetencii u studentov pedagogicheskih napravlenij podgotovki** [Comprehensive diagnostics of the components of research competence in pedagogical students]. *Obrazovanie i nauka*, 2019, vol. 21(1), pp. 37-58. https://doi.org/10.17853/1994-5639-2019-1-37-58. (In Russian)

2. **Slepukhin A.V., Sergeeva N.N. The diagnostics' methods of students' readiness for professional pedagogical activity within information educational environment**. *In Smart Education and Smart e-Learning, Springer International Publishing*, 2018, pp. 154-163.

3. **Choriev I. Efficiency of the model of formation and development of readiness for pedagogical design in the conditions of information and communication technologies**. *European Journal of Research and Reflection in Educational Sciences*, 2019, vol. 7(12), pp. 619-624.

4. **Barnett B.G., Muth R. Using action-research strategies and cohort structures to ensure research competence for practitioner-scholar leaders**. *Journal of Research on Leadership Education*, 2008, vol. 3(1), pp.3-42.

5. **Pakulina S.A., Keteiko S.M. Metodika diagnostiki motivacii ucheniya studentov pedagogicheskogo vuza** [Methodology for diagnosing the learning motivation of students at a pedagogical university]. Available at: https://:www.psyedu.ru, 2010, vol. (1), pp.1-11. (accessed 20 February 2024). (In Russian)

6. **Seredenko P.V. Puti i formy' podgotovki budushhih pedagogov k osushhestvleniiu issledovatelskogo podhoda k obucheniiu** [Ways and forms of training future teachers to implement a research approach to teaching]. Yuzhno-Sahalinsk, SahGU, 2010, pp.34-44. (In Russian)

7.**Krokhina J.A., Aleksandrova N.S., Buldakova N.V., Ashrafullina G.S., Shinkaruk V.M. Monitoring Technology: The Qualimetric Foundations of the Educational Process of the University**. *International Journal of Environmental and Science Education*, 2016, vol.11(14), pp. 7215-7225.

8. **Glynn S.M., Brickman P., Armstrong N., Taasoobshirazi G. Science motivation questionnaire II: Validation with science majors and nonscience majors**. *Journal of research in science teaching*, 2011 vol. 48(10), pp.1159-1176.

9. **Vallerand R.J., Pelletier L.G., Blais M.R., Briere N.M., Senecal C., Vallieres E.F. The Academic Motivation Scale: A measure of intrinsic, extrinsic, and amotivation in education.** *Educational and psychological measurement*, 1992, vol. 52(4), pp.1003-1017.

10. **Dmitriev D.S. The results analysis of innovative educational tools use in teacher professional activity.** *Sovremenny'e informacionny'e tehnologii i IT-obrazovanie*, 2019, vol. 15(4), pp.855-865.

11. **Motivacii uchebnoj deyatel'nosti: urovni i tipy'** [Motivation of educational activities: levels and types]. Available at: http://testoteka.narod.ru/ms/1/21.html (accessed 20 February 2024). (In Russian)

12. **Genshun W., Hui W.A.N.G. Strategy and Practice of Undergraduate Research Competence Building in Research Universities in China [J].** *Tsinghua Journal of Education*, 2008, vol. 29(4), pp.44-48.

13. **Sorochan T.M., Bondarchuk O.I., Olifira L. M. Experience-technologies in the development of information readiness of pedagogical employees for the performance of their professional activities.** *Information Technologies and Learning Tools*, 2020, vol. 76(2), pp.279-289.

14. **Safargaliev E.R., Eremina I.I., Konstantinovich S.S., Camelina V. A. Mathematical Model and Qualimetric Assessment of Graduate Education Quality in Environment Saturated with Information and Communication Technologies**. *International Education Studies*, 2015, vol. 8(2), pp.78-83.

15. **Junusova R.A., Seithanova A.K. Pedagogikalyq tazhiribe barysynda studentterdin zertteu areketterin zhuzege asyruga dajyndygyn qalyptastyru** [Forming Readiness of Students to Implement Research Activities in Pedagogical Practice]**.** *Iasaui universitetinin habarshysy*, 2024, vol. 3 (133), pp. 367-379. https://doi.org/10.47526/2024-3/2664-0686.99. (in Kazakh)

16. **Tunik E.E. Modificirovanny'e kreativny'e testy' Vil'yamsa** [Modified Williams creativity tests]. Saint Petersburg, Rech', 94, 2003, pp. 50-51. (In Russian)

**Information about the authors:**

*Zhunussova Russangul Aitmagambetovna* – PhD student, Senior Lecturer of the Higher School of Natural Sciences, Alkey Margulan Pavlodar Pedagogical University, Republic of Kazakhstan, 140001 Pavlodar, 68 Toraigyrov Str. 68, office 401v, tel.: +7-777-938-66-16, e-mail: rzhunusova@mail.ru.*

*Seitkhanova Ainur Kuspekovna – PhD, Associate Professor of the Higher School of Natural Sciences, Alkey Margulan Pavlodar Pedagogical University, Republic of Kazakhstan, 140001 Pavlodar, 68 Toraigyrov Str. 68, office 401v, tel.: +7-777-938-66-16, e-mail: ainur1179@mail.ru.*

*Dakhin Alexandr Nikolayevich – Doctor of Pedagogical Sciences, Professor, Novosibirsk State Pedagogical University, Russian Federation, 630126 Novosibirsk, 28 Vilyuiskaya Str., tel.: 89139340252, e-mail: dakhin@mail.ru.*

*Жүнісова Русангүл Айтмағамбетқызы* – PhD докторанты, жаратылыстану жоғары мектебінің аға оқытушысы, Әлкей Марғұлан атындағы Павлодар педагогикалық университеті, Қазақстан Республикасы, 140001 Павлодар қ.,Торайғыров көш. 68, каб. 401в, тел.: +7-777-938-66-16, e-mail: zhunusova@mail.ru.*

*Сейтханова Айнур Куспековна – PhD, жаратылыстану жоғары мектебінің қауымдастырылған профессоры, Әлкей Марғұлан атындағы Павлодар педагогикалық университеті, Қазақстан Республикасы, 140001 Павлодар қ., Торайғыров көш. 68, каб. 401в, тел.: +7-777-938-66-16, e-mail: ainur1179@mail.ru.*

*Дахин Александр Николаевич – педагогика ғылымдарының докторы, профессор, Новосібір мемлекеттік педагогикалық университеті, Ресей Федерациясы, 630126 Новосібір қ., Вилюйский көш. 28, тел.: 89139340252, e-mail: dakhin@mail.ru.*

*Жунусова Русангуль Айтмагамбетовна – PhD докторант, старший преподаватель высшей школы естествознания, Павлодарский педагогический университет имени Әлкей Марғұлан, Республика Казахстан, 140001 г. Павлодар, ул. Торайгырова 68, каб. 401в, тел.: +7-777-938-66-16, e-mail: rzhunusova@mail.ru.*

*Сейтханова Айнур Куспековна – PhD, ассоцированный профессор высшей школы естествознания, Павлодарский педагогический университет имени Әлкей Марғұлан, Республика Казахстан, 140001 г. Павлодар, ул. Торайгырова 68, каб. 401в, тел.: +7-777-938-66-16, e-mail: ainur1179@mail.ru.*

*Дахин Александр Николаевич – доктор педагогических наук, профессор, Новосибирский Государственный педагогический университет, Российская Федерация, 630126 г. Новосибирск, ул. Вилюйская 28, тел.: 89139340252, e-mail: dakhin@mail.ru.*

МРНТИ 14.25.09
УДК 372.851
https://doi.org/10.52269/RWEP2522109

## СТРУКТУРИРОВАНИЕ МАТЕМАТИЧЕСКИХ ЗАДАЧ ДЛЯ РАЗВИТИЯ ИССЛЕДОВАТЕЛЬСКИХ НАВЫКОВ УЧАЩИХСЯ

*Зыкрина С.Ж.* – PhD, заместитель директора по научно-методической работе, Назарбаев Интеллектуальные школы, г. Кокшетау, Республика Казахстан.*

*Костангельдинова А.А. – кандидат педагогических наук, доцент, заведующий кафедрой математики, физики и информатики, Кокшетауский университет им. Ш.Уалиханова, г. Кокшетау, Республика Казахстан.*

*Бейсенбаева Г.К. – учитель математики, Назарбаев Интеллектуальные школы, г. Кокшетау, Республика Казахстан.*

*В статье раскрыта роль структурирования математических задач в развитии исследовательских навыков учащихся. Цель исследования заключается в оценке влияния структурированных задач на развитие у учащихся навыков анализа и систематизации информации. Для достижения цели исследования были определены следующие исследовательские задачи: оценить эффект от использования методов, направленных на развитие исследовательских навыков, провести серию занятий и качественный анализ знаний учащихся, разработать рекомендации по организации деятельности учителей с целью развития навыков анализа и систематизации информации. На основе анализа подготовлена классификация структурированных задач и выделены задачи с независимыми и с зависимыми компонентами. В зависимости от вида задачи были выделены особенности оценивания задач. На основе составления дескрипторов к задачам, был разработан метод применения структурированных задач для закрепления алгоритма решения задач. В процессе составления задач, структурированных в соответствии с исследовательской гипотезой, уча-*