ENHANCING THE RESEARCH COMPETENCIES OF FUTURE PHYSICS TEACHERS THROUGH SOLVING OLYMPIAD PROBLEMS

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ABSTRACT

This article explores the potential of Olympiad tasks as a tool for developing research competencies in future physics teachers. Contemporary educational standards emphasize not only deep subject knowledge but also the ability to foster students' research, critical, and creative thinking skills. Nevertheless, an analysis of teacher education programs shows that Olympiad tasks receive insufficient attention, which restricts opportunities for effective training. To address this gap, a survey was conducted among students, undergraduates, doctoral candidates, and practicing physics teachers. The findings reveal a generally low level of knowledge and skills related to solving Olympiad problems. Based on these results, the study proposes practical recommendations for integrating Olympiad tasks into the educational process. These include developing methodological approaches for their application, conducting experimental testing, and preparing guidelines for teachers. Such integration can enhance the quality of teacher training and contribute to the formation of essential research competencies.

Keywords: olympiad tasks, research competencies, training of physics teachers, pedagogical education, methods of teaching physics.

INTRODUCTION

As you know, in the modern world, where science and technology are developing at an incredible rate, education is facing new challenges. Physics teachers, as key figures in shaping students' scientific worldview, should not only have deep subject knowledge, but also be able to apply it in non-standard situations, as well as develop students' research skills. However, the training of future teachers is often limited to the transfer of theoretical knowledge and teaching methods, which does not meet modern requirements for teachers' professional competencies.

Modern educational standards emphasize the formation of universal learning activities among students, including the ability to analyze, hypothesize, conduct experiments and solve complex problems. A physics teacher, as a mentor and guide to the world of science, must have these skills himself in order to effectively teach students. However, an analysis of existing teacher training programs shows that the development of research competencies among future physics teachers remains insufficiently developed.

Research competencies include: the ability to set research goals and objectives; the ability to put forward and test hypotheses; skills in data analysis and interpretation of results; the ability to apply theoretical knowledge to solve practical problems. These competencies are necessary not only for scientific activity, but also for effective teaching. A teacher with such skills can better motivate students, involve them in research projects, and develop their interest in physics as a science.

Many researchers have dealt with the issues of scientific research competencies of future teachers, in particular physics, at different times. V.A. Belyanina, A.B. Usova, O.V. Fedina, E.A. Yaburova are devoted to the formation of educational research activities in physics [1, 2, 3, 4].

It should be noted the works of A.E. Abylkasymova, Sh.T. Taubayeva, N.D. Khmel, in which research educational activity is considered as the 8th factor in the fundamentalization of teacher training for professional activity [5, 6, 7, 8].

The works of foreign researchers Thacker, I., Seyranian, V., Madva, A., Duong, N. T., & Beardsley, P. [9] are devoted to studying the role of online learning in supporting social connectedness and engagement of STEM students, including future physics teachers, emphasizing the importance of interactive methods and feedback for the development of their research competencies.

Anisimova, T. I., Sabirova, F. M., & Shatunova, O. V. [10] in their research studied the formation of design and research competencies within STEAM education, offering methods that integrate science, technology, engineering, art and mathematics for the effective development of research skills.

The article by Wen, X., & Korsun, I. [11] is devoted to demonstrating the possibilities of using physical tasks to form the research competence of future physics teachers using the example of the general physics course "Optics". The authors substantiate the expediency of using research tasks that allow deeper disclosure of the decision process in accordance with the methodology of scientific research, including the formulation of hypotheses, their justification and proof in the course of independent work.

The article by A. Akzholova discusses the organizational and pedagogical conditions for the development of research competencies of future physics teachers through laboratory classes. The author offers recommendations for improving the content and methodology of laboratory classes to increase the effectiveness of this process.

At the same time, it must be admitted that little attention is paid to the development and application of Olympiad tasks as a means of forming the professional competencies of future physics teachers both in the practical activities of pedagogical universities and in the specialized literature. Olympiad tasks have a significant potential for developing students' analytical, creative and research thinking, as well as for deepening their subject knowledge and methodological skills. However, their systematic use in the educational process of pedagogical universities remains insufficiently studied and implemented.

We can see it in the research work on attracting students to the production of non-standard and Olympic problems. The Balta & Asikainen [12] study compared the approaches and achievements of Olympiad winners and ordinary students in solving difficult dynamics problems. It was found that the Olympians, through logical thinking and in-depth analysis of problems, found more effective solutions than

ordinary students. The study emphasizes the importance of effective methods in teaching physics and the need to develop critical thinking.

Yatsura et al. [13], considering the importance of solving school Olympiad tasks in the professional training of future physics teachers, Drobin, A. The article [14] discusses the methodological features of the distance conduct of the student Olympiad in physics. The author analyzes the advantages and possibilities of such a format, offering effective methods for organizing the Olympiad in a virtual format.

The Hanáková [15] study states that the effectiveness of the evaluation systems used in physics Olympiads is analyzed taking into account the complexity of physics and mathematics, while the Valisheva, Krutova, & Amantaeva [16] Study examines the role of solving problems of physics Olympiads in the formation of cognitive independence of schoolchildren.

P.S. Tikhonov's article considers new approaches aimed at improving students ' skills in solving experimental Olympic problems in courses of professional development of physics teachers. In conclusion, the author notes the need for further research in this direction.

Many of the above and other studies are focused on the methodology of teaching schoolchildren to solve physical problems, and the training of teachers who teach them is neglected. Diagnostic studies have shown that students in higher education are not enough for future physics teachers to master the method of solving Olympic problems. In connection with the above, the purpose of this work is to explore the potential of using Olympiad tasks as a means of forming the research competencies of future physics teachers.

MATERIALS AND METHODS

To achieve this goal, the available educational programs of universities - the Sarsen Amanzholov East Kazakhstan University and the Khoja Akhmet Yassawi International Kazakh-Turkish University - served as a material. A survey was conducted among students of 2-3 courses, undergraduates, doctoral students of the Physics Department, as well as among schoolchildren and physics teachers of the city of Ust-Kamenogorsk.

The following classical methods were used in the qualification study in this work [17]:

- theoretical methods: analysis of literature on tribology and methodology;
- practical methods: questionnaire (survey);
- methods of data processing and interpretation.

Thus, the leading research method at this stage was a questionnaire (survey), which made it possible to assess the level of knowledge, skills and competencies of each participant in the study (students, teachers and school teachers) with a certain probability. This method provided an opportunity to collect quantitative and qualitative data that can be used to analyze the current state of training for future physics teachers, as well as to assess the potential of using Olympiad tasks in the educational process.

RESULTS

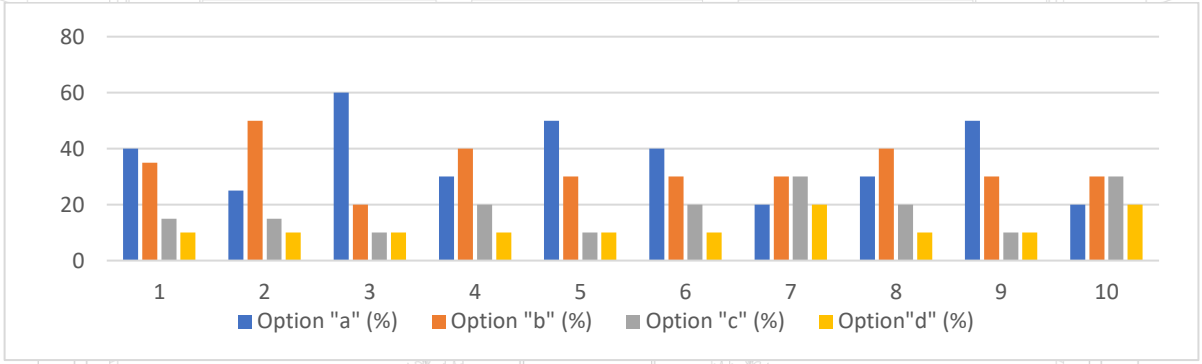
163 people took part in the survey (Table 1). The survey was uploaded to Google disk according to the link provided on the social network https://docs.google.com/forms he answered.

Table 1- Survey participants

Name of the institution	Educational program	Type of training	Number of students
Sarsen Amanzholov East Kazakhstan University	6B01502 - Physics	Bachelor's degree	20
	7M01502 - Physics	Master's students	28
	8D01502 - Physics	Doctoral studies	6
Khoja Akhmet Yassawi International Kazakh-Turkish University	6B01502 - Physics	Bachelor's degree	50
	7M01502 - Physics	Master's students	25
	8D01502 - Physics	Doctoral studies	6
Ust-Kamenogorsk city schools (5 schools)	Subject "Physics"	Teachers and students	28

In the course of the formation of practical working skills and solving physical Olympiad problems, 10 questions were asked to determine the level of research qualifications, the level of knowledge of the information necessary for the future profession (Fig. 1, 3, 5).

In the questionnaire, when answering some questions, along with choosing from the suggested answers, participants were given the opportunity to express their opinions. The answer involved choosing several options. The table also shows the percentage of responses selected by the survey participants.



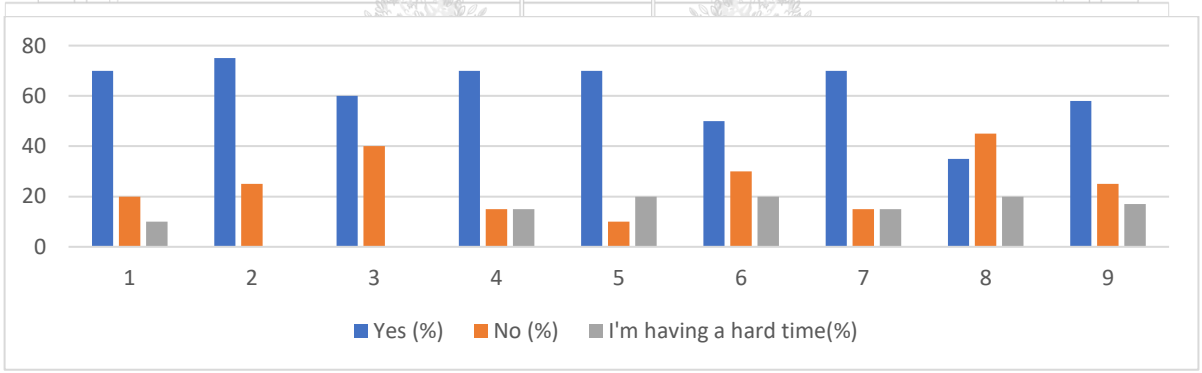


Figure 1 – Diagram of survey results No. 1 / Figure 2 – Diagram of survey results No. 2

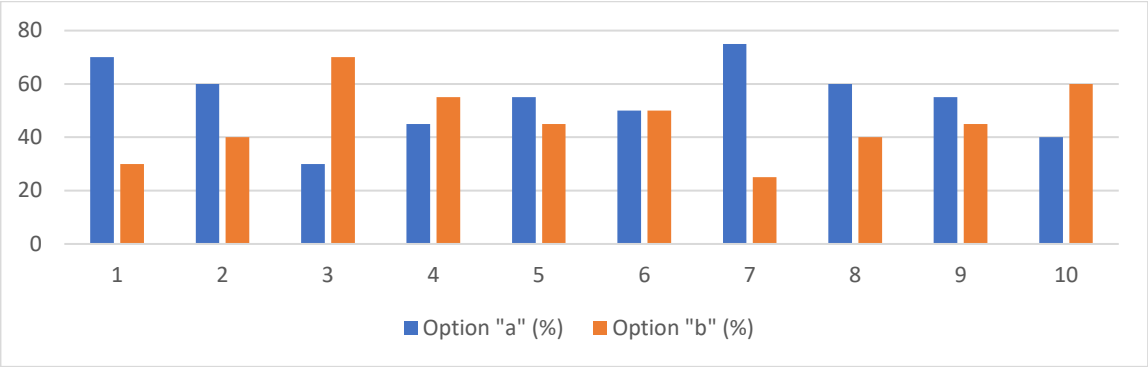


Figure 5 – Diagram of survey results No. 3

The analysis of the questionnaires revealed both the advantages and disadvantages of using Olympiad tasks in teaching physics.

Table 1 – Summary results of the questionnaire on Olympiad problems in physics

The positive aspects	Negative aspects
1. Olympiad tasks develop non-standard thinking and a creative approach to solving problems.	1. Insufficient knowledge of concepts related to Olympiad tasks (for example, "non-standard task", "physical modeling").
2. Solving Olympiad problems increases interest in the in-depth study of physics.	2. Insufficient amount of time to solve Olympiad tasks in the educational process.
3. Olympiad tasks help to better understand the fundamental laws of physics and their application.	3. Insufficient development of teaching methods for solving Olympiad problems.
4. They develop skills in analysis, logical thinking, and the application of physical laws.	4. Insufficient knowledge of the mathematical apparatus necessary to solve Olympiad problems.
5. Participation in Olympiads increases motivation to study physics and scientific activities.	5. Insufficient number of teaching aids and teaching materials on Olympiad tasks.
6. Olympiad tasks contribute to the development of independent work and research skills.	6. Difficulties in assessing knowledge and skills acquired while solving Olympiad tasks.
7. Teachers who prepare students for Olympiads deepen their professional skills and knowledge.	7. Insufficient teacher training for learning how to solve Olympiad problems.
8. Olympiad tasks develop physical intuition and the ability to apply knowledge in new situations.	8. Insufficient attention to Olympiad tasks in the school curriculum.
9. Solving Olympiad tasks helps you better prepare for exams and further education.	9. Insufficient availability of resources (tasks, literature, courses) for preparation for Olympiads.
10. Olympiad tasks contribute to the development of scientific thinking and interest in research.	10. Insufficient support and motivation from the school and parents to participate in the Olympiads.

The analysis of the results shows that Olympiad tasks develop non-standard thinking, motivation and professional skills of teachers, but lack of time, methodological support and educational materials, as well as difficulties in applying mathematical and physical apparatus create problems for students and teachers.

CONCLUSION

Olympiad tasks can be a powerful tool to overcome these limitations. Their use in the training of future physics teachers will allow students to develop critical and

creative thinking skills; teach them how to apply theoretical knowledge in non-standard situations; develop the ability to set and solve research problems. In addition, working with Olympiad tasks will help future teachers better understand how to motivate students, develop their interest in physics, and prepare them to participate in Olympiads and scientific competitions. The formation of research competencies among future physics teachers has not only educational, but also social significance. Teachers with such competencies can: to contribute to improving the quality of physics and mathematics education; to prepare students to participate in scientific projects and Olympiads; to educate a new generation of scientists and engineers capable of solving global problems.

Thus, the development of a methodology for using Olympiad tasks to form the research competencies of future physics teachers is an urgent and sought-after task that can make a significant contribution to the development of modern education.

The relevance of the topic is due to the need to modernize the training of future physics teachers in a rapidly changing educational landscape. The use of Olympiad tasks as a means of forming research competencies opens up new opportunities for improving the quality of teacher education and training teachers who are able to effectively solve professional tasks and foster students' interest in science. The development and implementation of an appropriate methodology can be an important step in achieving these goals.

Thus, the analysis of the level of formation of future specialists' ideas about the role of solving Olympiad tasks as a means of forming the research competencies of future physics teachers allows us to state that there is a low level of knowledge and skills related to the development and application of Olympiad tasks in the educational process. This indicates the need for more active implementation of such tasks in the methodological training of future teachers to develop their research potential and professional skills.

To increase the level of competence of future physics teachers in Olympiad tasks, it is recommended to solve the following tasks:

- to provide in the educational program additional study of "Physics of the Olympic Games solving problems ";
- to develop a methodology for using Olympiad tasks in the educational process of pedagogical universities for the formation of research competencies;
- experimentally verify the effectiveness of the proposed methodology in a real learning process;
- to develop practical recommendations for teachers of pedagogical universities on the implementation of Olympiad tasks in the training of future physics teachers.

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