

ABSTRACT
to the dissertation of Polatuly Serik
for the degree of Doctor of Philosophy (PhD) in Physics

Research topic: Formation of research competence of future physicists based on the case study method.

The purpose of the study: determination of the scientific and theoretical basis and methodological features of the formation of the research competence of future physicists on the basis of a case study.

Research objectives:

- formation of research competence of future physicists and analysis of the current situation of research work based on the case study method;
- creation of a methodological system for the formation of research competence of future physicists using a STEAM-case;
- determination of methodological features of the formation of research competence using the case method for future physicists on the example of teaching the subject «Optics»;
- assessment of the potential of the case study methodology in the formation of research competence through pedagogical experiment;

To solve the tasks set in the work, a set of research methods is used.

Research methods: in accordance with the objectives of the research work, the following quantitative and qualitative research methods were used, aimed at finding solutions and verifying scientific assumptions:

- From theoretical research methods: theoretical models of physics teaching, their explanatory and predictive potential were analyzed. The analysis of highly rated scientific journals in Google scholar and Scopus databases, Web of science, as well as articles published on the topic in Russian science (nauka.kz). The analysis was carried out in kazakh and english on the basis of the keywords «Case study», «Physics», «Future physics specialists», «STEM/STEAM case», «Scientific research», «competence», etc.

- The theoretical research work was implemented at the 2nd stage. At the first stage, a review of the general literature was conducted. Among them, the works that served as the basis for our research were analyzed. In the course of the study, problems were identified on the topic. At the second stage of the study-in the course of studying the topics of optics- an analysis of educational and educational programs was carried out in order to identify the possibilities of solving a number of pedagogical, didactic and technological problems through a STEAM case.

- From the methods of empirical research, the following were used: generalization of scientifically-based data, study of the pedagogical experience of future physicists, work on the analysis of textbooks and educational literature on physics, optics, methods of designing models to support research tasks. In addition, during the pedagogical experiment, the methods of questioning, interviewing, and observation were used in several stages. Mathematical and statistical analysis of the results of the pedagogical experiment was carried out using a two-sided (chi-squared) criterion.

Scientific novelty of the study

- The features of the formation of the research competence of future physicists on the basis of the case method are revealed;
- The didactic conditions for the implementation of STEAM-oriented research work based on the case study method are determined;
- A methodological system for the formation of research competencies of future physicists has been developed on the example of teaching the discipline «Optic» based on the case study method;
- The content of the formation of research competencies of future physicists is developed and the effectiveness of the methodological system is experimentally proved.

The key points of the dissertation to be submitted:

- The peculiarity of the use of case technology in the formation of students' research competencies in teaching physics and individual subjects in the field of physics and didactic conditions for the implementation of research works focused on STEAM;
- Methodological system for the formation of research competencies of future physicists on the example of teaching the discipline «Optic» by the case study method based on the development of research and applied orientation;
- The results of a pedagogical experiment organized to assess the potential of the case study methodology in the formation of research competence.

Обоснование новизны и важности полученных результатов:

The validity of the first result reveals the potential of the case method as a tool for the formation of students' research competence in the field of physics.

The validity of the second result determines the didactic conditions for the implementation of research work using cases based on STEAM knowledge;

The validity of the third result on the basis of the case study method, a methodological system for the formation of research competencies of future physicists has been developed on the example of teaching the discipline «Optics».

The validity of the fourth result lies in the fact that the content of the formation of research competencies of future physicists has been developed, the effectiveness of the methodological system has been experimentally evaluated.

Compliance with the directions of science development or state programs:

The main idea of the study corresponds to the state program for the development of education and science of the Republic of Kazakhstan for 2023-2029, the mandatory standard of education, the annual messages of the President of the Republic of Kazakhstan Kassym-Jomart Tokayev to the people of Kazakhstan.

The contribution of the doctoral student to the preparation of each publication (the contribution of the author of the dissertation is indicated, measured as a percentage of the total volume of the publication):

1. Effectiveness of Computer Modeling in the Study of Electrical Circuits: Application and Evaluation. International Journal of Engineering Pedagogy (iJEP), 13(4), pp. 93–112. <https://doi.org/10.3991/ijep.v13i4.34921>

(Процентиль 81). (Dosymov, Y., Usembayeva, I., Ramankulov, S., Kurbanbekov, B., Mintassova, A., Mussakhan, N) Share of doctoral student – 40%.

2. Физиканы оқытуда білімгерлердің ғылыми-зерттеу күзiреттiлiктерiн қалыптастырудағы кейс-технологияның әлеуетiн бағалау. Қазақстанның ғылымы мен өмiрi, Халықаралық ғылыми-көпшiлiк журналы, – Астана, 2020. –№12(7)(153). – Б. 410-415. (Атаханова Г.) Share of doctoral student – 80%.

3. STEAM technology as a tool for developing creativity of students: on the example of a school physics course. Ясауи университетiнiң хабаршысы, «Педагогика және пәндi оқыту әдiстемесi», Түркiстан. – 2022. –№4 (126). –Б200 -211. (Ramankulov Sh., Choruh A.), Share of doctoral student – 75%.

4. Физиканы оқытудың қолданбалы бағытын дамыту үшiн steam технологиясын қолдану. Абай атындағы ҚазақҰПУ «физика- математика ғылымдары» Хабаршысы. Том 80 № 4 (2022). Б. 277-284. (И.Б.Усембаева, Ш.Ж.Раманкулов, Ж.М.Битибаева, М.С.Молдабекова) Share of doctoral student – 50%.

5. The use of case technology in the formation of students' research competencies. In oral and technical presentation, recognition and appreciation of research contributions to International Pearson Conference on Social Sciences & Humanities-III October 26-27, 2021 / Nevşehir. (Ramankulov Sh., Pattayev A.) Share of doctoral student – 70%.

6. Smart technologies - as a system of advanced technologies for teaching optics in english. Scientific discussion (Praha, Czech Republic), VOL 1, No 75, (2023). 22-27 б.б. (Tolebayeva A., Zhumatova A., Ramankulov Sh.) Share of doctoral student – 70%.

7. Жарық құбылыстарын оқытуда цифрлық бiлiм беру ресурстарын пайдаланудың мүмкiндiктерi. Материалы международной научно-практической конференции «Актуальные проблема обучения математике и физике в школе и вузе в условиях обновленного содержания образования, Алматы, 2022. С.371-375. (Раманкулов Ш.) Share of doctoral student – 80%.

8. Methodological foundations for the development of research activities of students. С.Аманжолов атындағы ШҚУ 70 жылдығына арналған «Қазiргi сын-қатерлер жағдайындағы ғылым мен бiлiмнiң өзектi мәселелерi» «Уәлиев оқулары-2022» Халықаралық ғылыми-тәжiрибелiк конференцияның материалдар жинағы, Өскемен, 2022. 211-215 б.б. Share of doctoral student – 100%.