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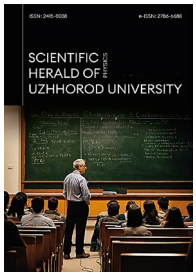

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Didactic training of future physics teachers to apply innovative technologies in educational process in the Kyrgyz Republic

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Abstract

Relevance. In the modern world, it is a trained teacher capable of sparking interest students and using innovations in the educational process who can teach physics to schoolchildren qualitatively.

Purpose. This determined the purpose of this study – to cover the features of training future physics teachers to use modern technologies in their professional activities.

Methodology. To fulfil the purpose, this study employed methods of analysis and synthesis, as well as interviews and the author's questionnaire to determine the readiness to use innovative technologies (IT).

Results. Basic competences were described that a future physics teacher should possess to implement a quality educational process. The role of modern technologies in teaching physics to schoolchildren was defined, and the main innovations that can be used in the learning process were described. To determine the readiness of future physics teachers to apply innovative technologies, a study was conducted among 95 students of Jusup Balasagyn Kyrgyz National University, as well as Osh State University. The findings showed that 52% of students are not ready for practical application of innovative technologies in the learning process, but have a high theoretical background, which proved the need to develop new didactic approaches to prepare future physics teachers for practical application of the acquired knowledge.

Conclusions. Based on the study results, didactic approaches to training future physics teachers to apply innovative technologies were proposed, which include cooperation of higher education institutions and schools, mentoring system, creation of microgroups for learning. The findings of this study can be used by the management of higher education institutions to improve the process of preparing students for professional activity, as well as by physics teachers for professional and personal development.

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Introduction

In the modern world, which is actively developing and modernising, quality education is one of the main values and the basis for the formation of the state's competitiveness. In terms of natural sciences, studying them is aimed at a more profound cognition of the world, development of logical thinking, ability to apply the acquired knowledge in real life situations and solve problems, both in the educational process and outside its scope. Teaching physics as a precise and complex science, development of necessary competences in schoolchildren and the necessity of correct construction of the educational process require teacher's qualitative training and developed pedagogical skills, ability to apply them in practice. However, the requirements of the modern world are such that apart from the basic pedagogical competences, a promising teacher must be proficient in innovative technologies (IT) at a prominent level to successfully apply them in the educational process and improve its effectiveness [1; 2].

Thus, investigating the development of special competences of a future teacher, A.S. Raimkulova [3] notes that quality education is a priority of the Kyrgyz Republic, and the training of future teachers should factor in the international standards and the changing requirements of the modern world. G. Karabalaeva & D. Kalibekova [4], studying the modernisation of higher education in the Kyrgyz Republic, also concluded that in the conditions of globalisation and internationalisation, the modern state needs changes in the training of pedagogical staff. Covering the role of problem solving in physics in the development of cognitive activity of schoolchildren, M.A. Nogaev *et al*. [5] note that the role of the teacher in teaching physics is to activate the cognitive activity of students, to maintain motivation to study natural sciences, to develop an active creative personality, capable of logical thinking and application of acquired knowledge in practice. According to researchers, only those teachers who organise educational work competently can achieve these goals, which requires quality training of teaching staff.

Investigating virtual laboratory classes in physics as a method of optimising student training, A.Z. Akmatbekova *et al*. [6] note the need to develop additional competences in future specialists aimed at mastering modern technologies as a method of improving the educational process. In terms of studying physics, researchers note that this process is complex, and the use of innovative methods within its framework is a multifunctional way to prepare future specialists for professional activity [7]. Covering the modern methods of teaching physics, U.K. Abdaliev & A.B. Satybaldyev [8] concluded that new educational paradigms require new approaches to the teaching of natural sciences and the use of modern technologies within them, which requires changes in educational programmes and, as a result, in the preparation of future teachers for professional activity. K.T. Berdibekova *et al*. [9], analysing the role of modern technologies in the training of a future teacher, also note that in the modern world, teachers, apart from standard pedagogical competencies, need to develop the ability to use modern technologies, which helps to make the pedagogical process more effective and efficient. However, the experts also concluded that at this stage in the Kyrgyz Republic, the training of teachers in the use of innovative technologies is at a low level, while funding and access to necessary resources are limited.

Thus, the significance of quality physics teaching in the Kyrgyz Republic is determined for the development of schoolchildren's competences necessary for further education and for the preparation of a competitive generation. To achieve these goals, the training of future physics teachers should meet modern standards and include the mastery of innovative technologies, using which it is possible to increase the effectiveness of the educational process and motivation of students to learn. However, the analysed studies note that at this stage of higher education development in the Kyrgyz Republic, future teachers are insufficiently prepared for the use of modern technologies, and the methods of improving their training are not covered. Proceeding from this, the purpose of this study was to provide methods of didactic training of future physics teachers to the application of modern technologies in professional activity.

Materials and Methods

This study employed such research methods as analysis and synthesis, as well as interviews and author's questionnaire to determine the readiness of future physics teachers to apply innovative technologies in the teaching process. The analysis was used to cover the reasons for the need for schoolchildren to learn science and to analyse the role of the teacher in this process. The analysis was also used to describe the main competences that a physics teacher should possess for quality teaching of schoolchildren based on the State Educational Standards of Higher Professional Education (SES HPE) of the Kyrgyz Republic in the fields 510400 Physics [10] and 550200 Physics and Mathematics Education [11]. The analysis was also used to describe the special competences required from a modern physics teacher and the methods of their development. This method helped to determine the role of innovative technologies in pedagogical activities, as well as to describe the possibilities of their use in teaching physics.

To analyse the readiness of future physics teachers to use innovative technologies in their professional activities and to identify problems in their university training, a study was conducted among 45 students of Jusup Balasagyn Kyrgyz National University (Faculty of Physics and Electronics) and 50 students of Osh State University (Faculty of Physics and Engineering). All students taking part in the study were 3rd and 4th-year students in the specialities "Physics" and "Physics and Mathematics Education". The age of the respondents was 21-25 years old, all students had experience of internship in different educational institutions of the Kyrgyz Republic, as well as experience of working with innovative technologies in their learning. The author's questionnaire was used to determine the readiness of future physics teachers to apply innovative technologies in the education process (Table 1). The questionnaire included two blocks, where Block A is

aimed at assessing students' theoretical knowledge of innovative technologies and possibilities of their use, while Block B is aimed at assessing practical skills of using innovative technologies in future professional activities.

Table 1. Author's questionnaire to determine the readiness of future physics teachers to apply innovative technologies in the education process

Block A				Block B			
No.	**Question**	**Yes**	**No**	**No.**	**Question**	**Yes**	**No**
1	Are you aware of the possibilities of using IT in your future activities?			1	Can you use IT in your future activities?		
2	Do you feel you are gaining enough knowledge about IT features?			2	Do you feel you are gaining enough skills to use IT?		
3	Do you study IT additionally outside the classroom?			3	Do you use IT additionally outside the classroom?		
4	Do you consider IT knowledge to be important for your professional life?			4	Do you consider the ability to use IT to be important to your professional life?		
5	Do you consider IT knowledge to be important for the professional activities of other specialities?			5	Do you consider the ability to use IT to be important for the professional activities of other specialities?		
6	Do you consider IT knowledge important for everyday life?			6	Do you consider the ability to use IT important for everyday life?		
7	Does your institution have sufficient scientific and methodological materials for IT knowledge?			7	Does your institution have sufficient facilities to develop IT skills?		

Source: compiled by the authors of this study.

The findings of this questionnaire helped to determine how ready students are for their future professional activity and the use of innovative technologies within it. Furthermore, the results of the questionnaire revealed the problems existing in preparing future teachers to use modern technologies in the education process, which helped to provide the most effective methods of didactic training. To confirm or refute the results obtained during the questionnaire survey, as well as to obtain additional information about the educational process of future specialists, an additional interview was conducted with the respondents, which included 4 questions:

1. What is your attitude towards innovative technologies in pedagogical activity?
2. Do you have any fears regarding the application of innovative technologies in your future professional activity? If so, describe them.
3. Have you taken additional courses/trainings on the use of innovative technologies in pedagogical activity (both within the educational institution and outside it)?
4. What innovative technologies do you consider key for your future professional activity?

The synthesis method was used to generalise the obtained results and to determine the degree of readiness of future physics teachers to use modern technologies in their future professional activities. Based on the obtained information, didactic approaches to preparing future physics teachers to use innovations were proposed. The synthesis was also used to draw the general conclusions of the study and to identify aspects requiring further consideration.

Results

The sphere of education and its modernisation based on international standards is an essential part of the development of a modern state and the training of competitive specialists capable of representing the country on the international labour market. In the modern world, an advanced educator, apart from conventional teaching methods, must include innovative methods and approaches in their professional activity and must be capable of using modern technologies. Thus, the Strategy for the Development of Education in the Kyrgyz Republic for 2021-2040 [12] emphasises the need to use modern technologies in combination with conventional approaches and traditional values, which will contribute to improving the quality of education and requires immediate improvement of approaches to the training of future teachers as a category that will influence the effectiveness of the educational process.

The Strategy for the Development of Education in the Kyrgyz Republic for 2021-2040 [12] defines general requirements for the training of students of various specialities. Specifically, during the educational process in higher education institution, the future teacher should have such qualities as purposefulness, high level of responsibility, organisation, communication skills, tolerance, aspiration for self-fulfilment and lifelong self-improvement. As for future physics teachers, they have an important task: to develop students' logical thinking, problem-solving ability, ability to apply knowledge in practice, and all the above should be the result of their high motivation for learning and aspiration for self-education, which should also be developed by a teacher. It is possible to develop motivation to learn and popularise self-education and self-development among the modern generation of schoolchildren using innovative technologies, which the future teacher must master to perform their main tasks and increase the effectiveness of the educational process.

Thus, in the State Standard of Higher Education in the field 510400 – Physics, the tasks of the future specialist are defined as follows: proficiency in teaching methods, preparation and conduct of classes and laboratory classes

in educational institutions of secondary and higher education, conducting extracurricular classes in physics, mastery of e-learning methods. At the same time, in the State Standard of Higher Professional Education in the field 550200 – Physics and Mathematics Education, the tasks of the future specialist are defined as follows: planning and implementation of educational activities according to modern methods and based on an individual approach to students, the use of modern tools and criteria for evaluating students, the development of didactic material, the development of students' ability to self-reflection and the desire for self-development, the organisation of effective interaction between all participants of the educational process, utilisation of all possibilities of the educational environment, including information technologies [13; 14]. Thus, based on the Strategy of Education Development of the Kyrgyz Republic until 2040 and the State Standard of Higher Education in the fields 510400 – Physics and 550200 – Physics and Mathematics Education, the future teacher of physics should have such competences as extensive knowledge in the field of physics, the ability to plan and manage pedagogical activity, to adapt it based on changes in the educational process and the requirements of modern education, high communication skills, the ability for self-development, fairness, responsibility and empathy, as well as mastery of innovative technologies and the ability to apply them in the educational process.

Innovative technologies that are used within physics teaching can include artificial intelligence [15], flipped classroom method [16], virtual labs [6; 17], augmented reality and virtual reality [17-19], and media (video, audio, interactive presentations) [17]. This makes didactic training of future physics teachers to use innovative technologies in their professional activity a vital part of their training in higher education. Training of future physics teachers to use innovative technologies should include both the accumulation of theoretical knowledge (awareness of innovative technologies, knowledge of methods of their use, understanding of their role in teaching their subject, the ability to plan their activities using innovative technologies) and the development of practical skills (the ability to apply innovative technologies effectively, to adapt their application to the specific topic of the lesson, to the needs of each individual class and each individual student, the ability to apply innovative technologies not only during the lessons, but also as a method of their professional and personal development).

To determine the aspects of current preparation of future physics teachers to use modern technologies in their future professional activities, a study was conducted among 95 students of Jusup Balasagyn Kyrgyz National University (Faculty of Physics and Electronics) and Osh State University (Faculty of Physics and Engineering) by means of questionnaires and interviews. The questionnaire survey demonstrated the following results: 56% of students (53 people) are aware of the possibilities of using innovative technologies in their future activities, but 52% of students (49 people) noted that they doubt their ability to use them in practice within their future professional activities. The majority of students (60% or 57 students) believe that the lack of skills in using innovative technologies in practice is caused by insufficient training in higher education institution. Therewith, 65% (62 people) of the respondents answered that they do not study innovative technologies additionally outside the educational process, but 84% (80 people) use innovative technologies in real life.

This may indicate that the theoretical training of students exceeds the practical training, thereby causing the uncertainty of future specialists in the ability to use the acquired knowledge in practice. Considering that the majority of respondents use innovative technologies outside the educational process, it can be assumed that with the correct selection of didactic training methods, it is possible to increase the readiness of students to use them in their future pedagogical activities. The significance of knowledge about innovative technologies for their future professional activity was noted by 91% (86 people) of students, while the significance of the ability to use them was noted by only 70% (66 people). However, the role of knowledge and skills regarding innovative technologies in the activities of other specialists was rated higher by the respondents: 94% (89 people) and 76% (72 people) respectively. This may indicate that future physics teachers do not understand the role of using innovative technologies in teaching science to students.

The need for knowledge and skills about innovative technologies was assessed by the respondents at a medium level: 48% (46 people) believe that knowledge about innovative technologies is important for everyday life, while 56% (53 people) believe that the skills to use them are important for real-life situations. In terms of training of future specialists within the framework of higher education institution, 67% of respondents (64 people) noted that their educational institution has enough scientific and methodological materials for obtaining knowledge about information technologies. However, only 52% of respondents (49 people) believe that their educational institution has sufficient material base for developing skills in the use of innovative technologies. This may indicate the need to change approaches to preparing future physics teachers to use innovative technologies based on available resources.

The results of the questionnaire showed that the main issues faced by future physics teachers in preparation for the use of innovative technologies in professional activity include lack of practical skills to apply the acquired knowledge, low awareness of the role of using innovative technologies in the educational process, insufficient involvement of higher education institution in the training process. The results obtained are presented in the figure below (Figure 1).

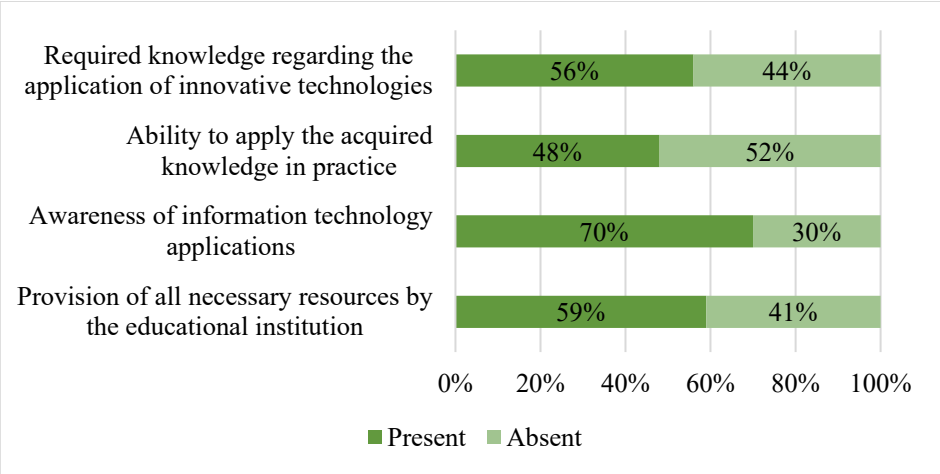

Figure 1. Results of the questionnaire to determine the readiness of future physics teachers to use innovative technologies in the education process

To confirm or refute the obtained results, as well as to determine the views of future physics teachers on their training and future professional activity, an interview was conducted. Most of the respondents believe that innovative technologies are essential in pedagogical activity. However, some respondents noted that they do not fully realise the role of IT in physics teaching, as they believe that teaching should be based on conventional methods and approaches, based on the accuracy of the discipline taught. This confirms that future teachers do not fully understand the role of modern technologies in the educational process and the possibilities of their use in teaching physics.

Approximately 30% (28 people) of the respondents indicated that they have fears regarding the application of innovative technologies in their future professional activities. The most frequent fears were fear of making mistakes when using IT, especially in the presence of students or the school management; fear of equipment malfunction and inability to handle it themselves, concerns about the confidentiality of data, both personal and of students. This demonstrates the unpreparedness of some specialists for professional activities, which requires additional attention from the higher education institution. Most students did not take part in additional activities concerning the use of innovative technologies in pedagogical activities. Those of the respondents who took courses/trainings noted that it was their personal initiative, and the additional educational activities themselves took place in an online format, which also required the ability to use innovative technologies. This demonstrates the need for greater involvement of higher education institutions in training specialists in the application of innovative technologies in professional activities and the development of new approaches to their training.

Among the key innovative technologies for their future professional activities, students most often noted: artificial intelligence, various software, interactive whiteboards, virtual laboratories, and game technologies, which can also be a reference point for higher education institutions. Thus, the interview results confirmed the problems of preparing future physics teachers to use innovative technologies in the education process, identified upon interviewing (Figure 2). Even though during the survey most students showed that they have the necessary knowledge regarding the application of innovative technologies and are aware of the possibilities of applying innovative technologies, not all of the interviewees can actually apply the acquired knowledge in practice. Furthermore, it was found that students were psychologically unprepared for professional activity.

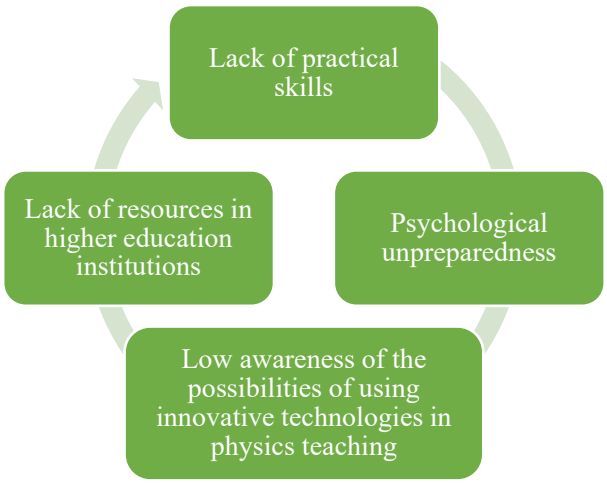

Figure 2. Problems of training future physics teachers to apply innovative technologies identified as a result of the study

Based on the received information, didactic approaches to training future physics teachers to use modern technologies in their professional activity were provided, which include cooperation of higher educational institutions and schools, mentoring system, creation of microgroups for training, use of modern technologies at the stage of preparation for educational activity.

Cooperation between higher education institutions and schools is necessary, first of all, to hone practical skills in conditions as close as possible to real professional activity. Within the framework of cooperation, future physics teachers can observe the use of innovative technologies by more experienced teachers, learn from their experience, as well as implement their ideas regarding the implementation of technologies in the educational process. Such cooperation can also help future teachers to overcome their fears and their psychological unpreparedness for professional activity: by observing the education process of more experienced teachers and noticing how they solve various problems arising during classes, students can realise their algorithm of actions in such situations, which can change their beliefs and reduce their fear of professional activity.

The mentoring system can also be useful for practising practical skills in the application of innovative technologies. The mentor may be a teacher from a higher education institution, a teacher from the institution where the student is doing their internship, or a specialist in the field of innovative technologies. One of the effective methods of mentoring can be the involvement of students from other specialities, namely such as computer science, information technology, software engineering, nanotechnology. Such interaction will be useful for all participants of this process: future physics teachers will have a mentor who is more experienced in the field of innovative technologies, who will be able to guide their activities, analyse the possibility of implementation of their ideas in the educational process and supervise them during their preparation for the application of innovative technologies, which can increase the effectiveness of professional activities in the future. At the same time, mentors from other specialities will be able to hone their skills and realise their ideas and projects in the field of innovative technologies.

Another effective method of didactic training of future physics teachers can be the creation of microgroups for training. Such groups are characterised by a small number of participants, common themes, and common goals. By interacting in microgroups, future specialists can exchange experience and develop joint projects on the use of innovative technologies in educational activities. Furthermore, microgroups actively develop communication and teamwork skills, which are necessary for a teacher both for successful pedagogical activity and for the successful application of innovative technologies.

It is important that preparation of future physics teachers to use innovative technologies in their professional activity should take place with application of said technologies. In this case, students will develop an understanding of the role of innovative technologies in the educational process, as they will be able to understand by personal example how it affects the perception of information, its memorisation, and the possibility of further application. Thus, in training future physics teachers to use innovative technologies, the following can be introduced: artificial intelligence (as a method of searching and collecting necessary information, a method of planning educational and later professional activities); video materials and presentations (as a method of visual perception of information for its better memorisation); virtual laboratories (as a method of mastering distance learning forms), mobile applications or computer programmes (Microsoft Office software package for planning educational and later professional activities); virtual laboratories (as a method of mastering distance learning forms), mobile applications or computer programmes (Microsoft Office software package for planning educational and later professional activities).

Furthermore, the findings of this study showed that some students are psychologically unprepared for the beginning of professional activity, which requires additional intervention: creation of psychological courses, organisation of meetings with experienced teachers, which will dispel the fears of future teachers and allow them to effectively conduct the pedagogical process and, using innovative technologies, to develop the necessary competences in schoolchildren, preparing them for further education and professional activity.

Discussion

The present study found that teaching physics to schoolchildren is a vital part of the educational process and a method of forming logical and critical thinking, the ability to scientific activity and application of knowledge in real life. In studying the issue of motivation to learn physics, R.M. Guido [20] also concluded that learning physics promotes the development of cognitive, scientific skills, and influences the ability to solve problems arising in real life situations. P. Noufal *et al*. [21] hold an analogous opinion, who, investigating the problems of teaching physics, noted that teaching natural sciences is a vital component of personal development and the development of scientific literacy. However, according to researchers, physics is considered to be a rather complex science, the teaching of which requires a special approach from teachers and the ability to motivate students to study it, which determines the need for constant revision of physics teacher training programmes.

In this study, it was noted that the main competences to be formed in the training of future physics teachers include extensive knowledge, ability to plan, manage, adapt pedagogical activities, high communication skills, ability to self-development, fairness, responsibility and empathy, knowledge of innovative technologies and ability to apply them. L. Jons & J. Airey [22] interviewed 11 physics teachers taking part in a teacher training programme where they identified criteria for a qualified teacher. The findings of the cited study showed that a highly qualified teacher has a thorough knowledge of physics and other sciences, practical skills that they can apply in practice, possesses modern methods, approaches, and technologies and uses them in the education process, which is in line with the results obtained in the present study. Furthermore, according to researchers, a modern teacher has such

qualities as the ability to communicate with students, individual approach to each student and psychological readiness for professional activity.

The use of modern technologies in the educational process is defined in this study as an effective method of motivating modern schoolchildren to study physics, a stimulus to self-development and self-education. This is confirmed by S. Tenzin *et al*. [23], who assessed the improvement of students' physics knowledge and skills through modern technology. The results of the study by S. Tenzin *et al*. [23] demonstrated that in the experimental group, where information and communication technologies were used in teaching, the average score increased by 46.9%, which proves the effectiveness of using innovations in teaching physics and, as a result, the need for quality training of future teachers to use them in the education process. Investigating the role of innovative technologies in physics teacher training and their future professional activities, P. Demkanin & D. Sands [24] concluded that one of the main tasks of a physics teacher is to use modern technologies and approaches in professional activities as a method of improving the effectiveness of the educational process, which was also found in the present study. M. Jauhariyah *et al*. [25] share the same opinion, who, when covering the aspects of physics teacher training, concluded that a modern teacher teaching science subjects should possess 21st century skills, which include mastery of innovative technologies, methods, and approaches to teaching. D. Mulhayatiah *et al*. [26], in turn, noted the relevance of the hybrid form of teaching in the modern world, which requires future physics teachers to be able to use modern technologies and, as a result, proves the need to develop innovative competences.

The findings of the conducted research indicated the problems in preparing future physics teachers for professional activity, which include lack of practical skills, lack of resources, low awareness of the possibilities of using innovative technologies in teaching physics, psychological unpreparedness. According to A. Şahinoğlu & A. Sağlam Arslan [27], another problem in preparing teachers to use innovative technologies in the education process is the reluctance of higher education institutions to modernise their training programmes and their commitment to conventional teaching methods exclusively. T. Liu & H. Sun [28] also see the problem in insufficient modernisation of future physics teacher education programmes and insufficient preparation for practice, which correlates with the findings of the present study. J.Y. Low *et al*. [29] share a similar idea, believing that the main problem that prevents teachers from using innovative technologies is the lack of experience in their practical use. J. Larsson & J. Airey [30] in their study among future physics teachers, identified additional problems that may occur in teacher training that were not covered in the present study: students' passivity and lack of motivation to learn, which makes training teachers to use innovative technologies in the education process more time-consuming and less effective. Based on the problems in didactic training of future physics teachers identified during the study, methods of preparing students to use modern technologies in their future professional activity were provided, which include cooperation between higher education institutions and schools, mentoring system, creation of microgroups for training, use of modern technologies at the stage of preparation for educational activity.

T. Liu & H. Sun [28], in their study of building a physics teacher education system based on cooperation between higher education institution and school, point out the positive impact of such interaction as a method of better preparing future teachers for their professional career, the opportunity to improve their practical skills and learn proper communication with colleagues and students, which coincides with the findings of the present study. A. Şahinoğlu and A. Sağlam Arslan [27] define mentoring as an effective way to prepare teachers for future professional activities, which has a positive impact on their development. B.F. Komolafe *et al*. [31], who compared physics teacher training programmes in China and Nigeria, considered microlearning as an effective way of preparing future specialists for professional activities and the use of modern approaches within it, as this type of interaction between students implies active practice of acquired knowledge, exchange of experience, and the possibility of implementing innovative ideas, which coincides with the findings obtained in the present study. M. Carli & O. Pantano [32] also considered collaborative group work as an effective method to improve competences and prepare for professional development. The researchers also concluded that such interaction could improve the quality of the educational process and contribute to the development of teachers in all areas, including digital competences.

In terms of the use of innovative technologies in the educational process of students as a method of preparation for their application by future specialists in the educational process, M. Schweinberger & R. Girwidz [33] note that innovative technologies are a vital part of students' preparation for professional activity, as well as the basis for the construction of a modern lesson, which was also established in the present study. Thus, the researchers investigated "silent videos" as a method of preparing educators for professional practice. The essence of "silent videos" is the use of video accompaniment without a soundtrack in the classroom. Instead, the teacher should voice the video, which develops teachers' pedagogical skills, the ability to explain the material in a way that is accessible to each individual class and each individual student, and the ability to apply innovative technologies in their work. The findings of the study by F. Herliana *et al*. [34], which covered the specific features of using the Quizizz application in teaching physics, showed that 91.7% of teachers highly appreciated the use of this innovation during the education process, which indicates the high efficiency of using mobile applications and computer programmes in training future specialists to use modern technologies in professional activities and correlates with the findings of the present study. However, N. Nasri *et al*. [35], analysing e-professionalism among students of physical sciences, note that when preparing future specialists to use innovative technologies in their professional activities, it is worth paying more attention to the safety of their application. Thus, students should be taught how to keep confidential information in case of using social networks, Internet resources in the educational

process, as well as the rules of their use, which was not detailed in the present study.

The analysed sources note that to teach physics to schoolchildren effectively, the modern teacher should be able to use innovative technologies and be qualitatively prepared for professional activity, which coincides with the findings of the present study. Apart from the problems identified in the study on preparing future specialists to use innovative technologies, researchers also highlight the reluctance of higher education institutions to modernise training programmes and the desire to base the didactic process on conventional methods, which reduces the ability of students to apply innovations in their professional activities. The researchers concluded that one of the main problems in didactic training is the lack of practical skills in using innovative technologies in future professional activities, and the methods proposed in the present study can be effective in developing the necessary competences in students. However, some studies point out the need to pay more attention to the rules of using innovative technologies and safety measures in their application, which will protect both future physics teachers and students, making the learning space comfortable and the learning process effective.

Conclusions

This study covered the specific features of didactic training of future physics teachers for professional activity and the use of innovative technologies within its framework. It was found that physics education is a vital part of schoolchildren's preparation for further education and future professional activities, as well as develops logical and critical thinking, the ability for scientific activity, problem solving, and the ability to apply the acquired knowledge in practice. To develop the described skills in schoolchildren, a future physics teacher should possess such competences as extensive knowledge in physics, ability to plan, manage, and adapt pedagogical activity, high communication skills, ability to self-development, fairness, responsibility and empathy, knowledge of innovative technologies and ability to apply them.

However, the analysed studies have suggested that the training of future specialists in higher education institutions of the Kyrgyz Republic is at a low level. To obtain relevant information on the state of training of future physics teachers, a study was conducted among 95 students of Jusup Balasagyn Kyrgyz National University and Osh State University. The findings of the study showed that students have formed knowledge about innovative technologies and possibilities of their application in the educational process, but 52% of respondents cannot apply this knowledge in practice. Furthermore, students are not aware of the possibilities of applying innovative technologies in their professional activities. It was also found that about 30% of the respondents are psychologically unprepared for professional activity and application of innovative technologies within its framework. The findings suggested the need to develop novel approaches to student training.

Proceeding from the study results, the following didactic approaches to training future physics teachers to apply innovative technologies in the education process: cooperation of higher education institutions and schools, mentoring system, creation of microgroups for training, use of modern technologies at the stage of preparation for learning activities. However, the priority in the use of innovative technologies should still be the safety of teachers and students, which can be ensured by observing the rules of their use.

The prospect of further research is the experimental verification of the effectiveness of the proposed approaches, coverage of the rules of using innovative technologies to ensure the high quality of the educational process, as well as analysis of the psychological readiness of future physics teachers for professional activities.

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None.

Conflict of Interest

None.

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Дидактична підготовка майбутніх учителів фізики до застосування інноваційних технологій в освітньому процесі в Киргизстані

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Анотація

Актуальність. У сучасному світі якісно викладати фізику школярам може лише підготовлений вчитель, здатний зацікавити учнів та використовувати інновації в навчальному процесі.

Мета. Це визначило мету даного дослідження – висвітлити особливості підготовки майбутніх учителів фізики до використання сучасних технологій у професійній діяльності.

Методологія. Для досягнення поставленої мети в цьому дослідженні використовувалися методи аналізу та синтезу, а також інтерв'ю та авторська анкета для визначення готовності до використання інноваційних технологій (ІТ).

Результати. Описано основні компетентності, якими повинен володіти майбутній вчитель фізики для здійснення якісного освітнього процесу. Визначено роль сучасних технологій у навчанні школярів фізики та описано основні інновації, які можуть бути використані у навчальному процесі. Для визначення готовності майбутніх вчителів фізики до застосування інноваційних технологій було проведено дослідження серед 95 студентів Киргизького національного університету імені Жусупа Баласагина, а також Ошського державного університету. Результати показали, що 52% студентів не готові до практичного застосування інноваційних технологій у навчальному процесі, але мають високу теоретичну підготовку, що довело необхідність розробки нових дидактичних підходів до підготовки майбутніх учителів фізики до практичного застосування отриманих знань.

Висновки. За результатами дослідження запропоновано дидактичні підходи до підготовки майбутніх учителів фізики до застосування інноваційних технологій, які включають співпрацю закладів вищої освіти і школи, систему наставництва, створення мікрогруп для навчання. Результати дослідження можуть бути використані керівництвом закладів вищої освіти для вдосконалення процесу підготовки студентів до професійної діяльності, а також учителями фізики для професійного та особистісного розвитку.

Ключові слова: сучасні методи; природничі науки; викладання; педагогічні компетенції; освіта.