SRSTI 14.01.29 https://www.doi.org/10.53355/ZHU.2025.116.3.006

TRAINING FUTURE PHYSICS TEACHERS IN THE CONTEXT OF DIGITAL EDUCATION

A.A. Kaliyeva[1], *G.B. Issayeva*[2,*]

[1]*SDU university, Republic of Kazakhstan, Kaskelen*
[2]*Abay Kazakh National Pedagogical University, Republic of Kazakhstan, Almaty*
[*]*e–mail: assem.kaliyeva@sdu.edu.kz, Guka_issaeva@mail.ru*

Abstract. This article examines the features of the professional training of future physics teachers in the context of digital education. It discusses the need to integrate modern technologies into the educational process, the development of digital literacy and the creation of exciting forms of learning to stimulate students' interest in physics. The authors highlight the importance of adapting educational material to the digital environment and developing teachers' competencies for the successful implementation of digital education. Moreover, the integration of modern technologies into the teaching of physics not only enhances students' engagement but also facilitates personalized learning experiences. By incorporating digital tools such as simulations, virtual laboratories, and interactive multimedia resources, educators can cater to diverse learning styles and provide students with hands–on experiences that are essential for grasping complex physical concepts.

In addition, the development of digital literacy among both students and teachers is crucial in navigating the vast amount of information available online and critically evaluating its reliability and relevance. Future physics teachers need to be proficient in using digital resources effectively to enhance their teaching methods and create dynamic learning environments that foster inquiry, experimentation, and collaborative problem–solving.

Keywords: *Digital education, physics teachers, vocational training, technology in education, digital literacy, exciting learning, digital educational resources.*

Introduction

Digitalization plays a key role in modern education, and the use of new learning technologies requires new levels of teacher competence. In particular, the professional training of future physics teachers or engineers corresponding to the requirements of the time in the context of digital education is of particular importance. This process is necessary not only for a deep understanding of the subject, but also for the ability to integrate the latest technologies to achieve maximum learning effectiveness. Studying physics in the digital age requires the ability to transfer basic sections of physics and the ability to use innovative methods, creating interactive environments in the learning process. The technology of creating events described in the book can be applied to absolutely all desires: health, money, relationships – to what every person living on earth wants. And we want to be healthy, beautiful, of course, have good relationships with children, parents, a life partner, find a dream job and, of course, an income that allows us not to think about this income [1]. The motivation of learning is a complex and in many ways still mysterious process. It is unlikely that we will ever be able to understand it completely, because the motives of the teaching are very mobile and changeable. The current ones do not necessarily have to be preserved tomorrow [2].

Methodology and materials

Integration of technology into the educational process:

1. Modern physics teachers should be able to effectively use various *digital teaching tools*: a) Working with an engineering calculator; b) Artificial intelligence; c) online resources for creating interactive lessons and training courses, e) also using virtual laboratories for conducting experiments.

A) Well–equipped engineering *calculators* are currently available. They were widely used at the end of the last century and at the beginning of current century. To gain skills in working on calculators and using them effectively, additional lessons were needed to master the capabilities of the calculator. But now, with a high level of computer development and, in particular, Artificial Intelligence, the use of a calculator is reduced to banal operations of product and division.

B) The use of *Artificial Intelligence* should be careful, because Artificial intelligence makes mistakes when It is solving problems in mathematics and physics. In this regard, it is advisable to learn from Artificial Intelligence the way of solutions, checking its solutions with your own hand. A physics teacher and his students should be able to solve problems 1) on a piece of paper with a pen; 2) using a calculator; 3) using Artificial Intelligence.

C) Future physics teachers should be equipped with the skills to work with modern technologies and be able to adapt to their constantly changing nature. In the Republic of Kazakhstan, there are qualification characteristics for the positions of pedagogical workers and job descriptions for the personnel of legal entities [3].

The purpose of this article is to explore the professional training of future physics teachers in the context of digital education. It focuses on the integration of modern technologies into physics instruction, the development of digital literacy among students and teachers, the structuring of interactive and engaging curricula using digital tools, and the evaluation of how laboratory work and virtual resources influence student engagement and academic performance. In doing so, the article also aims to highlight the competencies required by educators to navigate a constantly evolving digital environment, including the ability to critically assess and apply technological tools in line with pedagogical goals. Additionally, this study seeks to demonstrate how thoughtful course design – combining theoretical, practical, and virtual components – can address challenges in physics education and enhance the quality of teacher preparation programs in higher education institutions. These documents define the professional competencies and digital literacy requirements for future teachers [4].

Results and discussion

Following the article by A.N. Kosherbayeva [5] Effective components in the management structure of an educational organization, we will evaluate students according to the same scheme (Fig.3) the effectiveness of their activities, considering 50–69 – a low sufficient level of knowledge. 70–89 have an average sufficient level of knowledge in physics and 90–95 have a high level of knowledge.

Based on the results of the article, teachers explore the current state and prospects for the development of digital technologies in the country's educational system [6]. Discuss problems and challenges, and offer recommendations on integrating digital innovations into the educational process. Analyzes the social consequences of the introduction of digital technologies into university education, identifies the positive and negative sides of this phenomenon. They discuss the main trends and challenges facing this sector, as well as propose strategies for successful adaptation to the digital age. They say what competencies are necessary for future teachers in the context of digitalization of education. The main technologies and digital competencies necessary for the successful adaptation of universities to the digital age are highlighted [7].

This includes the ability to use tools and analyze their effectiveness in learning. The information contained on the *Internet* will serve as an additional source to increase the level of knowledge and increase students' interest in the subject. The Internet becomes a teacher for the teachers themselves. And in fact, the teacher is a researcher and takes his own refresher course every time. We would like to note the effectiveness of online courses for motivated students. Such courses save time, give them the opportunity to repeat watching a video lecture several times and do the study at a convenient time. And communication with the teacher becomes more accessible.

2. Digital education opens the door to *new learning methods* such as gamification, interactive assignments and online collaboration. Future physics teachers should develop the skills to create an exciting educational experience that stimulates students' interest in studying physics. They analyze modern methods of integrating digital tools into the learning process and their impact on the quality of education [8].

3. *Structuring* and *adapting* educational material: Mastering digital tools requires the ability to use them and the ability to adapt educational material for a digital learning environment, making it accessible and understandable to students. M.H. Meskon, M. Albert, F. Hedouri point to the relationship between structure and strategy: “The best structure is the one that best allows the

organization to interact effectively with the external environment, to distribute the efforts of its employees productively and expediently and to achieve its goals with high efficiency” [9].

Modern digital education requires future physics teachers not only to have in–depth knowledge of the subject, but also the ability to integrate advanced technologies into the learning process. The use of modern digital tools, the creation of interactive lessons and the development of digital literacy are becoming important components of professional training. The emphasis on the fascination of the educational experience and the adaptation of educational material to the digital learning environment stimulate students' interest in physics. The training of physics teachers in the era of digital education should be dynamic and focused on the development of skills necessary for the successful integration of technology into the educational process. The authors emphasize the importance of teacher readiness for digital transformation and the development of new professional competencies [10].

Despite the high level of technology and computer capabilities, a complete presentation of the course of the subject and proper planning of the material requires additional time. Therefore, this structuring of the presentation of the material will help new newly arrived teachers in preparing for classes, and in particular this structuring will give a complete picture of the course to young teachers who are reading this course for the first time. The study also examines the pedagogical conditions that ensure the effective implementation of digital technologies in the training of future physics teachers [11].

The shown functions in relation to the school have specific features and sub–functions. P.I. Tretyakov in his book “Managing the School by Results” identifies these functions based on the consideration that the management process for all self–governing systems boils down to the fact that the functional links of management are considered relatively independent activities. Meanwhile, all of them are interconnected and successively, gradually replace each other, forming a single management cycle [12]

State Program for the Development of Education of the Republic of Kazakhstan for 2020–2025 notes that commercialization offices, technology parks, business incubators, and implementation units have been created in higher education organizations and research institutes. However, the scientific infrastructure does not meet modern requirements for the implementation of scientific research. In this regard, the Program provides a set of measures to upgrade and modernize the scientific infrastructure, measures to modernize the infrastructure and develop the digital skills of scientists, and the creation of a unified information system of science in Kazakhstan [13].

Our physics course was taught without laboratory work and the students' interest in the subject was lower, as there were the students' exam results. Now that 6 laboratory works have appeared, the attitude towards the subject has become different. Therefore, structuring such a course with six laboratory papers is of particular importance for a new look at teaching this section at the university.

We conducted a study among students, their interest in the subject of physics and their results in the certificate with and without laboratory work. And we see that there is a big difference in grades in physics certificates.

The presented tables illustrate the structured approach to designing, adapting, and evaluating the physics course within a digital learning environment. [14] Table 1 shows the correlation between access to laboratory work and students’ academic performance, emphasizing the importance of practical experimentation in enhancing understanding and engagement. Tables 2 and 3 detail the adaptation of educational materials for the “CSS–112” course: Table 2 outlines weekly lecture topics, textbook references, and key formulas, providing a clear roadmap for consistent content delivery, while Table 3 links each lecture to specific laboratory activities, formulas, and virtual resources, demonstrating the integration of digital tools and simulations that bridge theory and practice. Table 4 presents the assessment structure, distributing grades across laboratory work, quizzes, midterms, and finals to ensure balanced evaluation of theoretical and practical skills, and Table 5 summarizes the grading system, defining how each component contributes to the final mark. Collectively, these tables represent a cohesive course design that integrates lectures, laboratory work, and digital resources to enhance both motivation and achievement in physics education.

Table 1 – The average score at physics in the certificate, depending on the availability of laboratory work

Physics at school	The average score in physics in the certificate
There were laboratory works	4,9
There was no laboratory work	4,46

This structuring was created for a complete presentation of the physics course in the second semester: 1 hour of lectures, 2 hours of laboratory work, 1 hour of practice.

Table 2 – Structuring and adaptation of educational material in corresponding to the Syllabus of Course CSS–112.

Weeks	The topic of the lecture	The topic of the lecture	Physical formulas
1	Electric Fields Ch. 23.	P. 716–724 [15] 4,11,12,13,15,19,25,29,33,36,42, 44,45,50, 52	[15] p.694
2	Gauss Law Ch.24	P. 740–745 [15] 4, 6, 8, 11, 15, 17, 20, 21, 24, 29,35,38,39,44,46.	[15] p.730
3	Electric Potential Ch. 25	P. 769–776 [15] 5, 11, 14, 15, 17, 18, 19, 24, 26, 29, 33, 34, 36, 38, 41.	[15] p.755
4	Capacitance and Dielectrics Ch. 26	P. 800–807 [15] 10, 11, 12, 20, 21, 22, 24, 25, 28, 48, 58, 63, 65, 69, 75.	[15] p.780
5	Current and Resistance ch.27 .	P. 826–832 [15] 6, 8, 12, 18, 20, 25, 27, 29, 35, 39, 40, 45, 58, 61, 63.	[15] p.813
6	Direct–Current circuits ch. 28.	P. 857–867 3, 7, 9, 11, 15, 19, 24, 27, 29, 33, 35, 38, 43, 45, 62.	[15] p.837
7	Magnetic Fields Ch.29	P. 894–903 6, 11, 14, 17, 21, 24, 27, 29, 33, 39, 40, 41, 51, 55, 59.	[15] p.883
8	MidTerm (23–28)	Quiz 1	
9	Sources of the Magnetic FieldsCh. 30.	P. 925–934 5, 7, 10, 11, 13, 25, 34, 38, 39, 44, 47, 56, 57, 68, 74.	[15] p.905
10	Faraday s LawCh. 31	P. 958–969 6, 13, 14, 16, 20, 26, 31, 34, 36, 37, 54,	[15] p.937

Weeks	The topic of the lecture	The topic of the lecture	Physical formulas
		60, 61, 68, 76.	
11	Inductance ch 32	P. 989–997 9, 10, 11, 18, 19, 20, 45, 46, 62, 63, 65, 69, 70, 72, 77.	[15] p.971
12	Alternating Current CircuitsCh. 33	P.1023–1029 3, 5, 7, 10, 16, 18, 21, 30, 32, 37, 46, 48, 50, 54, 72.	[15] p.1001
13	Electromagnetic WavesandMaxwell s Equations Ch.33	P.1023–1029 4,11,12,13,15,19,25,29,33,36,42, 44,45,50.	[15] p.1001
14	End Term	Quiz 2 during the practice hour	
15	No lecture (Review week)	Preparation for Exam and	

Table 3 – Structuring and adaptation of educational material in corresponding to the Syllabus of Course CSS–112.

Week	The topic of the lecture	Laboratory work in Physics	Physical formulas	Keywords	Virtual Laboratory work
1	Electric Fields Ch. 23.	Theory of errors	[15] p.4	The **electric field,** the electric force,	https://courses.minia.edu.eg/Attach/15676Lecture%20on%20Electrostatic–book–one%20and%20two.pdf
2	Gauss Law Ch.24	examination of Kirchhoff's voltage law	[15] p.7	Electric field, force, potential, electric charge. Gauss low in dielectric.	
3	Electric PotentialCh. 25	examination of serially connected resistors	[15] p.17	Electric field, electric potential. Conductor.	
4	Capacitance and Dielectrics Ch. 26	examination of parallel connected capacitors	[15] p.26	Capacitance, farad, dielectric constant, dipole moment.	https://physicsinstrumentation.wordpress.com/wp–content/uploads/2016/09/raymond_chp26_capacitance.pdf

Week	The topic of the lecture	Laboratory work in Physics	Physical formulas	Keywords	Virtual Laboratory work
5	Current and Resistance ch.27 .	examination of serial connected capacitors	[15] p.37	Electric current, density, potential difference or voltage.	
6	Direct–Current circuits ch. 28.	examination of parallelly connected resistors	[15] p.52	Resistance, ampermeter, voltmeter. Joule's low. Electrical power. Generalized Ohm's low	https://faculty.ksu.edu.sa/sites/default/files/chapter%2028–%20Direct%20Current%20Circuits.pdf
7	Magnetic Fields Ch. 29		[15] p.62	Magnetic and magnetic fields.	
8	MidTerm (23–28)				
9	Sources of the Magnetic FieldsCh. 30.	study of electromagnets	[15] p.69	North pole and sloth pole. Magnetic induction.	
10	Faraday s LawCh. 31		[15] p.80	Biot and Savart's low.	https://phet.colorado.edu/en/simulationsfaradays–law
11	Inductance ch 32	Examination of resistances in alternating current	[15] p.85	Inductance, tesla	
12	Alternating Current Circuits Ch. 33	examination of the capacitance in the ac circuit	[15] p.90	Inductance, current. Amper's theorem	
13	Electromagnetic WavesandMaxwell s Equations Ch.33	study of electromagnets	[15] p.95	Electromagnetic Wavesand Maxwell s Equations	
14	EndTerm				
15	No lecture				

Table 4 – The structure of students' assessment in the 2nd semester on the subject of physics (section electricity and magnetism)

Lab work №1 (5%)	Quiz 1 (5%)	***	Final (40%)
Lab work №2 (5%)	Quiz 2 (5%)	***	***
Lab work №3 (5%)	***	Mid–term 1 (8%)	***
Lab work №4 (5%)	***	Mid– term 2 (7%)	***
Lab work №5 (5%)	***	***	***
Lab work №6 (5%)	***	Practice exercise (5%)	Total (100%)

Table 5 – Assessments

Activity	Quantity	Points for one	Total points	Final exam	Total result
Quiz	2	5	10		
Laboratory	6	5	30		
Midterm exam	2	7+8	15		
Practice		15	5		
Pre–final			60	40	100

Conclusion

Teaching any subject is a very difficult process. Physics is one of the most important subjects of mankind. Physics as a science had a great influence on the development of mankind and on the development of man as an individual. Man has always been interested in nature and the processes taking place around him. Indeed, physics is one of the fundamental scientific disciplines that is of great importance for the development of mankind. Physics studies nature, its laws and principles, and explains various phenomena and processes taking place in the world around us.

The interest in physics is due to a person's desire to understand the surrounding world and its structure. Physics helps us understand how the universe works, from the nanoscale of atoms and molecules to cosmic objects and galaxies. Its laws underlie many other scientific disciplines and technical achievements.

In addition, the study of physics contributes to the development of thinking, logic, analytical and experimental skills. This science requires a person to be able to abstract, formulate hypotheses, investigate and verify them. In the process of learning physics, a person learns to think critically, adapt to new situations and find solutions to complex problems.

Thus, physics plays a key role in shaping not only scientific thinking, but also the general cultural level of a person. Studying it helps us to better understand ourselves, our universe and our place in it, and also contributes to the development of technology and the progress of humanity as a whole.

Teaching any subject is a very complex process. Therefore, for a complete and in–depth presentation of the full physics course in the second semester in the electricity and magnetism section, we have presented for you the structuring of this subject. This article will be of interest to specialists and will also be useful for students to effectively master the material in the process of studying this section of physics.

Currently, the hours allocated to this subject in the curriculum are decreasing every year. Therefore, to quickly see the connection between all sections on the topic of electricity, such structuring is necessary.

Authors contributions

Conceptualized the research study, provided the overall direction for the article, and drafted the majority of the manuscript. Conducted an extensive review of current digital education technologies and their application in the field of physics education. Coordinated the structuring of the physics curriculum and the integration of digital tools into the syllabus.

Contributed to the development of the methodology section, focusing on the integration of modern teaching technologies into the educational process. Conducted research on the use of artificial intelligence and online resources for creating interactive lessons. Analyzed the effectiveness of these tools in enhancing student engagement and learning outcomes.

LITERATURE:

1 Гумерова Д.К. Технология создания событий. Методы управления своей жизнью. – 2022 – 100 с.

2 Подласый И.П. Педагогика: Учебное пособие для студентов педагогических вузов. – Москва: Академия, 2009. – 540 с.

3 Кошербаева А. Научно–практические основы управления и развития менеджмента современной школы // Научно–педагогический журнал «Білім–Образование» Национальной академии образования имени И. Алтынсарина. – 2023. – № 2(105). – С. 25–32.

4 Садвакасова З.М. Педагогический менеджмент: учебное пособие. 2–е изд., доп. – Алматы, 2012. – 187 с.

5 Кошербаева А.Н., Дементьева Н.Г., Сансызбаева Д.Б., Кошербаева Г.Н. Эффективные компоненты в структуре управления образовательной организацией // Вестник Евразийского национального университета им. Л.Н. Гумилева. Серия «Педагогика. Психология. Социология». – 2023. – № 4(145). – С. 145–161. DOI: 10.32523/2616–6895–2023–145–4–145–161

6 Сарсенбиева Н.Ф., Мырзахметова B.Sh., Адылбекова Е.Т. Цифровизация образования в Республике Казахстан // Мир педагогики и психологии: международный научно–практический журнал. – 2021. – № 1(54). [Электрон. ресурс]. https://scipress.ru/pedagogy/articles/tsifrovizatsiya–obrazovaniya–v–respublike–kazakhstan.html (дата обращения: 04.11.2022).

7 Ларионов В.Г., Шереметьева Е.Н., Горшкова Л.А. Цифровая трансформация высшего образования: технологии и цифровые компетенции // Вестник Астраханского государственного технического университета. Серия «Экономика». – 2021. – № 2. – С. 61–69. DOI: 10.24143/2073–5537–2021–2–61–69

8 Минина В.Н. Цифровизация высшего образования и ее социальные результаты // Вестник Санкт–Петербургского университета. Социология. – 2020. – Т. 13. – Вып. 1. – С. 84–101. DOI: 10.21638/spbu12.2020.106

9 Мескон М., Альберт М., Хедоури Ф. Основы менеджмента. – 1997. Доступно по адресу: http://www.gidromet.edu.kh.ua/Files/downloads/80.pdf (дата обращения: 03.02.2023).

10 Гаврилюк Е.С., Изотова А.Г. Основные направления и факторы цифровой трансформации сектора науки и образования // Научный журнал НИУ ИТМО. Серия «Экономика и экологический менеджмент». – 2021. – № 1. – С. 22–30. DOI: 10.17586/2310–1172–2021–14–1–22–31

11 Андрюхина Л.М., Ломовцева Н.В., Садовникова Н.О. Концепции цифровой дидактики как основы проектирования дополнительного образования для преподавателей профессионального образования // Профессиональное образование и рынок труда. – 2020. – № 1. – С. 30–43. DOI: 10.24411/2307–4264–2020–10103

12 Третьяков П.И. Управление школой по результатам: практика педагогического менеджмента. – Москва: Триада, 1998. – 283 с.

13 Об утверждении Государственной программы индустриально–инновационного развития Республики Казахстан на 2020–2025 годы // Постановление Правительства Республики Казахстан от 31 декабря 2019 года № 1050. [Электрон. ресурс]. – 2022. http://adilet.zan.kz/rus/docs/P1900001050 (дата обращения: 20.10.2022).

14 Fishbane P.M., Gasiorowicz S.G., Thornton S.T. Physics for Scientists and Engineers with Modern Physics. 3rd ed. – New Jersey, USA: Pearson Prentice Hall, 2020. ISBN 9780130352996

15 Raymond A. Serway John W. Jewett, Jr. Physics Edition for Scientists and Engineers with Modern Physics. Ninth Edition. – 2013 – P. 1622.

REFERENCES:

1 Gumerova D.K. (2022). Tekhnologiya sozdaniya sobytiy. Metody upravleniya svoey zhiznyu [Technology of creating events. Methods of self–management]. – 100 p. (in Russian)

2 Podlasy I.P. (2009). Pedagogika: Uchebnoe posobie dlya studentov pedagogicheskih vuzov [Pedagogy: Textbook for students of pedagogical universities], Academiya, Moscow, 540 p. (in Russian).

3 Kosherbaeva A.N., Dementyeva N.G., Sansyzbayeva D.B., Kosherbaeva G.N. (2023). Effektivnye komponenty v strukture upravleniya obrazovatel'noy organizatsiey [Effective components in the structure of educational organization management]. Vestnik Evraziyskogo natsional'nogo universiteta im. L.N. Gumileva. Seriya "Pedagogika. Psikhologiya. Sotsiologiya", 4(145), pp. 145–161. https://doi.org/10.32523/2616–6895–2023–145–4–145–161 (in Russian)

4 Sadvakasova Z.M. (2012). Pedagogicheskiy menedzhment: uchebnoe posobie [Pedagogical management: textbook]. 2nd ed., rev. Almaty: [publisher]. (in Russian)

5 Kosherbaeva A. (2023). Nauchno–prakticheskie osnovy upravleniya i razvitiya menedzhmenta sovremennoy shkoly [Scientific and practical foundations of management and development of modern school management]. Nauchno–pedagogicheskiy zhurnal "Bilim–Obrazovanie" Natsional'noy akademii obrazovaniya imeni I. Altynsarina, 2(105), pp. 25–32. (in Russian)

6 Sarsenbieva N.F., Myrzakhmetova B.Sh., Adylbekova E.T. (2021). Tsifrovizatsiya obrazovaniya v Respublike Kazakhstan [Digitalization of education in the Republic of Kazakhstan]. Mir pedagogiki i psikhologii: Mezhdunarodny nauchno–prakticheskiy zhurnal, 1(54). Retrieved November 4, 2022, from https://scipress.ru/pedagogy/articles/tsifrovizatsiya–obrazovaniya–v–respublike–kazakhstan.html (Data obrashhenija: 04.11.2022). (in Russian)

7 Larionov V.G., Sheremetyeva E.N., Gorshkova L.A. (2021). Tsifrovaya transformatsiya vysshego obrazovaniya: tekhnologii i tsifrovye kompetentsii [Digital transformation of higher education: technologies and digital competencies]. Vestnik Astrakhanskogo gosudarstvennogo tekhnicheskogo universiteta. Seriya "Ekonomika", 2, pp. 61–69. https://doi.org/10.24143/2073–5537–2021–2–61–69 (in Russian)

8 Minina V.N. (2020). Tsifrovizatsiya vysshego obrazovaniya i ee sotsial'nye rezul'taty [Digitalization of higher education and its social results]. Vestnik Sankt–Peterburgskogo universiteta. Sotsiologiya, 13(1), pp. 84–101. https://doi.org/10.21638/spbu12.2020.106 (in Russian)

9 Mescon M., Albert M., Hedouri F. (1997). Osnovy menedzhmenta [Fundamentals of management]. Retrieved February 3, 2023, from http://www.gidromet.edu.kh.ua/Files/downloads/80.pdf (Data obrashhenija: 03.02.2023). (in Russian)

10 Gavrilyuk E.S., Izotova A.G. (2021). Osnovnye napravleniya i faktory tsifrovoy transformatsii sektora nauki i obrazovaniya [Main directions and factors of digital transformation in science and education sector]. Nauchnyy zhurnal NIU ITMO. Seriya "Ekonomika i ekologicheskiy menedzhment", 1, pp. 22–30. https://doi.org/10.17586/2310–1172–2021–14–1–22–31 (in Russian)

11 Andryukhina L.M., Lomovtseva N.V., Sadovnikova N.O. (2020). Kontseptsii tsifrovoy didaktiki kak osnovy proektirovaniya dopolnitel'nogo obrazovaniya dlya prepodavateley professional'nogo obrazovaniya [Concepts of digital didactics as a basis for designing continuing education for vocational teachers]. Professional'noe obrazovanie i rynok truda, 1, pp. 30–43. https://doi.org/10.24411/2307–4264–2020–10103 (in Russian)

12 Tretyakov P.I. (1998). Upravlenie shkoloy po rezultatam: praktika pedagogicheskogo menedzhmenta [School management by results: practice of pedagogical management]. Moscow: Triada. (in Russian)

13 Government of the Republic of Kazakhstan. (2019). Ob utverzhdenii Gosudarstvennoy programmy industrial'no–innovatsionnogo razvitiya Respubliki Kazakhstan na 2020–2025 gody [Approval of the State program of industrial–innovative development of the Republic of Kazakhstan for 2020–2025]. Resolution No. 1050. Retrieved October 20, 2022, from http://adilet.zan.kz/rus/docs/P1900001050 (Data obrashhenija: 20.10.2022). (in Russian)

14 Fishbane P.M., Gasiorowicz S.G., Thornton S.T. (2020). Physics for Scientists and Engineers with Modern Physics (3rd ed.). New Jersey, USA: Pearson Prentice Hall. ISBN 9780130352996.

15 Raymond A. Serway John W. Jewett, Jr. (2013) Physics Edition for Scientists and Engineers with Modern Physics. Ninth Edition, pp. 1622.

ЦИФРЛЫҚ БІЛІМ БЕРУ КОНТЕКСТІНДЕ БОЛАШАҚ ФИЗИКА МҰҒАЛІМДЕРІН КӘСІБИ ДАЯРЛАУДЫҢ ЕРЕКШЕЛІКТЕРІ

Калиева А.А.[1], Исаева Г.Б.[2,]*

[1]СДУ университеті, Қазақстан Республикасы, Қаскелең қ.
[2]Абай атындағы Қазақ ұлттық педагогикалық университеті, Қазақстан Республикасы, Алматы қ.
[*]e–mail:assem.kaliyeva@sdu.edu.kz, Guka_issaeva@mail.ru

Аңдатпа. Бұл мақалада цифрлық білім беру контекстінде болашақ физика мұғалімдерінің кәсіби дайындығының ерекшеліктері қарастырылады. Онда заманауи технологияларды білім беру процесіне интеграциялау, цифрлық сауаттылықты дамыту және оқушылардың физикаға деген қызығушылығын ояту үшін оқытудың қызықты түрлерін құру қажеттілігі талқыланады. Авторлар оқу материалын цифрлық ортаға *бейімдеудің және цифрлық білім беруді сәтті енгізу үшін мұғалімдердің құзыреттілігін дамытудың маңыздылығын атап көрсетеді. Сонымен қатар, физиканы оқытуда заманауи технологияларды біріктіру оқушы–лардың белсенділігін арттырып қана қоймайды, сонымен қатар жеке оқытуға ықпал етеді. Модельдеу, виртуалды зертханалар және интерактивті мультимедиялық ресурстар сияқты цифрлық құралдарды пайдалана отырып, оқытушылар әртүрлі оқу стильдеріне бейімделе алады және студенттерге күрделі физикалық тұжырымдамаларды түсіну үшін қажетті практикалық тәжірибе бере алады.*

Сонымен қатар, студенттер мен оқытушылар арасында цифрлық сауат–тылықты дамыту Интернетте қол жетімді ақпараттың үлкен көлемін шарлау және оның сенімділігі мен өзектілігін сыни бағалау үшін өте маңызды. Болашақ физика мұғалімдері өздерінің оқыту әдістерін жетілдіру және зерттеуді, экспериментті және проблемаларды бірлесіп шешуді жеңілдететін Динамикалық оқу ортасын құру үшін цифрлық ресурстарды тиімді пайдалана білуі керек.

Кілт сөздер: *цифрлық білім, физика мұғалімдері, кәсіптік оқыту, білім берудегі технологиялар, Цифрлық сауаттылық, қызықты оқыту, цифрлық білім беру ресурстары.*

ОСОБЕННОСТИ ПРОФЕССИОНАЛЬНОЙ ПОДГОТОВКИ БУДУЩИХ УЧИТЕЛЕЙ ФИЗИКИ В КОНТЕКСТЕ ЦИФРОВОГО ОБРАЗОВАНИЯ

Калиева А.А.[1], *Исаева Г.Б.*[2,*]

[1]*Университет СДУ, Республика Казахстан, г. Каскелен*
[2]*Казахский национальный педагогический университет имени Абая, Республика Казахстан, г. Алматы*
[*]*e–mail: assem.kaliyeva@sdu.edu.kz, Guka_issaeva@mail.ru*

Аннотация. В данной статье рассматриваются особенности профессиональной подготовки будущих учителей физики в контексте цифрового образования. В ней обсуждается необходимость интеграции современных технологий в образовательный процесс, развитие цифровой грамотности и создание увлекательных форм обучения для стимулирования интереса учащихся к физике. Авторы подчеркивают важность адаптации учебного материала к цифровой среде и развития компетенций учителей для успешного внедрения цифрового образования. Более того, интеграция современных технологий в преподавание физики не только повышает вовлеченность учащихся, но и способствует индивидуальному обучению. Используя цифровые инструменты, такие как моделирование, виртуальные лаборатории и интерактивные мультимедийные ресурсы, преподаватели могут адаптироваться к различным стилям обучения и предоставить учащимся практический опыт, необходимый для понимания сложных физических концепций.

Кроме того, развитие цифровой грамотности как среди учащихся, так и среди преподавателей имеет решающее значение для навигации по огромному объему информации, доступной онлайн, и критической оценки ее надежности и актуальности. Будущие учителя физики должны уметь эффективно использовать цифровые ресурсы для совершенствования своих методов преподавания и создания динамичной учебной среды, способствующей исследованию, экспериментиро–ванию и совместному решению проблем.

Ключевые слова: *Цифровое образование, учителя физики, профессиональная подготовка, технологии в образовании, цифровая грамотность, увлекательное обучение, цифровые образовательные ресурсы.*