R.A. Karatabanov, A.A. Saipov, B.X. Balgabaeva, K.T. Saparov. 2-bolim. - Almaty`: Almaty` kitap baspasy`, 2019. -184 b.

19. Baranaydın, M,. Aydın, Y., Tekbaş, G. Ortaöğretim Coğrafya ders kitabı: 9- sınıf [Secondary school Geography textbook] [Text]. - Ankara: Gün, 2022. -231 s.

20. Marteau J.F. Post-COVID education in Kazakhstan: Heavy losses and deepening inequality 2020, 16 November [Электронный ресурс] URL:https://blogs.worldbank.org/ru/europeandcentralasia/post-covid-education-kazakhstan-heavy-losses-and-deepening-inequality

21. Ob utverzhdenii Gosudarstvennoj programmy` razvitiya obrazovaniya i nauki Respubliki Kazaxstan na 2020 - 2025 gody` [On approval of the State program for the development of education and science of the Republic of Kazakhstan for 2020-2025] [Electronic resource] // URL:https://adilet.zan.kz/kaz/docs

МРНТИ 14.25.09 https://doi.org/10.51889/2959-5762.2024.82.2.028

Sadykov T.,[1] Kokibasova G.,[1] Konyukhova M.,[2] Unerbaeva Z.[3]*

[1]Buketov Karaganda University, Karaganda, Kazakhstan
[2]General education school named after G.Potanin, Karaganda, Kazakhstan
[3] Abai Kazakh National Pedagogical University, Almaty, Kazakhstan

FEATURES OF THE DEVELOPMENT OF PROGRAMMED CHEMISTRY LESSONS FOR STUDENTS OF THE 9TH GRADE OF SECONDARY SCHOOL

Abstract

One of the main directions for improving the training of teachers in a modern educational institution is the introduction of interactive forms of education. The coronavirus pandemic has clearly shown the world that in the field of education, means are needed to advance to the first stage of a person's ability to self-study without the presence of a subject of learning (teacher, coach, supervisor, tutor, etc.) at any distance from the educational institution. The training programmes must be user-friendly and simple for understanding for both the teacher, who created the program's content, and any student. The purpose of our work is to develop programmed chemistry lessons, as well as to test their effectiveness. As part of our research, chemistry lessons were conducted on the topics: «Nitrogen», «Properties of ammonia, preparation and application», «Nitric acid», «Specific properties of nitric acid and nitrates», «Phosphorus and its compounds». The study involved two ninth grades, which were divided into control and experimental classes. According to the results of the study, it can be concluded that the use of programmed teaching methods can contribute to a more effective assimilation of educational material and improve student academic performance. The results of the survey provide information about the degree of reflection of students, which can help in the development of effective strategies and teaching methods.

Keywords: interactive methods, programmed learning, computer program, chemistry, software simulator, secondary school.

Садыков Т.М.,[1] Кокибасова Г.Т.,[1] Конюхова М.О.,[2] Унербаева З.О.[3]*

[1]Академик Е.А.Бөкетов атындағы Қарағанды университеті, Қарағанды қ., Қазақстан
[2]Григорий Потанин атындағы жалпы білім беретін мектебі, Қарағанды қ., Қазақстан
[3]Абай атындағы Казақ ұлттық педагогикалық университеті, Алматы қ., Республикасы

ОРТА МЕКТЕПТІҢ 9-СЫНЫП ОҚУШЫЛАРЫНА АРНАЛҒАН БАҒДАРЛАМАЛАНҒАН ХИМИЯ САБАҚТАРЫН ӘЗІРЛЕУ ЕРЕКШЕЛІКТЕРІ

Аңдатпа

Қазіргі оқу орнында педагогтарды даярлауды жетілдірудің негізгі бағыттарының бірі оқытудың интерактивті түрлерін енгізу болып табылады. Коронавирустық пандемия әлемге білім беру саласында оқу орнынан кез-келген қашықтықта оқу субъектісінің (мұғалім, жаттықтырушы, басшы, тьютор және т.б.) қатысуынсыз адамның өзін-өзі оқыту қабілетін бірінші сатыға көтеруге мүмкіндік беретін құралдар қажет екенін айқын көрсетті. Сонымен қатар, оқу бағдарламалары кез-келген қолданушы (оқушы) үшін де, бағдарлама мазмұнын жасаушы (мұғалім) үшін де интуитивті, түсінікті болуы маңызды. Біздің жұмысымыздың

мақсаты-химиядан бағдарламаланған сабақтарды әзірлеу, сонымен қатар олардың тиімділігін тексеру. Біздің зерттеуімізде «Азот», «Аммиактың қасиеттері, алынуы және қолданылуы», «Азот қышқылы", «Азот қышқылы мен нитраттардың ерекше қасиеттері», «Фосфор және оның қосылыстары» тақырыптары бойынша химия сабақтары өткізілді. Зерттеуге бақылау және эксперименттік сыныптарға бөлінген тоғызыншы екі сынып қатысты.

Зерттеу нәтижелері бойынша бағдарламаланған оқыту әдістерін қолдану оқу материалын тиімдірек игеруге және оқушылардың үлгерімін арттыруға ықпал етуі мүмкін деген қорытынды жасауға болады. Сауалнама нәтижелері оқушылардың рефлексия дәрежесі туралы ақпарат береді, бұл оқытудың тиімді стратегиялары мен әдістерін жасауға көмектеседі.

Түйін сөздер: интерактивті әдістер, бағдарламаланған оқыту, компьютерлік бағдарлама, химия, бағдарламалық тренажер, орта мектеп.

Садыков Т.М.,[1] Кокибасова Г.Т.,[1] Конюхова М.О.,[2] Унербаева З.О.[3]

[1] Карагандинский университет имени Е.А. Букетова, г.Караганда, Казахстан
[2]Общеобразовательная школа имени Григория Потанин, г.Караганда, Казахстан
[2]Казахский национальный педагогический университет имени Абая, г.Алматы, Казахстан

ОСОБЕННОСТИ РАЗРАБОТКИ ПРОГРАММИРОВАННЫХ УРОКОВ ПО ХИМИИ ДЛЯ УЧАЩИХСЯ 9-ЫХ КЛАССОВ СРЕДНЕЙ ШКОЛЫ

Аннотация

Одним из основных направлений совершенствования подготовки педагогов в современном учебном заведении является внедрение интерактивных форм обучения. Пандемия коронавируса чётко показала миру, что в сфере образования необходимы средства, позволяющие выдвинуть на первую ступень способность человека самообучаться без присутствия субъекта обучения (учителя, тренера, руководителя, тьютора и т.д) на любом расстоянии от учебного заведения. При том важно, чтобы программы для обучения были интуитивными, понятными как для любого пользователя (ученика), так и для разработчика содержания программы (педагога). Целью нашей работы является разработка программированных уроков по химии, а также проверка их эффективности. В рамках нашего исследования проводились уроки по химии по темам «Азот», «Свойства аммиака, получение и применение», «Азотная кислота», «Специфические свойства азотной кислоты и нитратов», «Фосфор и его соединения». В исследовании приняли участие два девятых класса, которые были разделены на контрольный и экспериментальный классы. По результатм исследования, можно сделать вывод о том, что использование программированных методов обучения может способствовать более эффективному усвоению учебного материала и повышению успеваемости учащихся. Результаты анкетирования предоставляют информацию о степени рефлексии учеников, что может помочь в разработке эффективных стратегий и методик обучения.

Ключевые слова: интерактивные методы, программированное обучение, компьютерная программа, химия, программный тренажер, средняя школа.

Basic provisions. The Republic of Kazakhstan is actively developing programmed learning and introducing interactive lessons into the educational process. In 2018, the Ministry of Education and Science of the Republic of Kazakhstan launched the project "Unified Educational Information Environment", the purpose of which is to create a nationwide e-education system. This project included the development of interactive programmed classes in a variety of areas, including computer science and programming. The online platform "Adaptive Learning" established in Kazakhstan is one of the most popular interactive learning systems. It gives students access to interactive lectures as well as adaptive tests that help measure knowledge and determine an individual learning path [1].

In this article, we will focus on the consideration of programmed learning as one of the more important teaching methods, especially after the pandemic. The principle of programmed learning is founded on the idea of organising the educational process such that students can autonomously acquire new information, skills, and abilities using specially designed didactic materials. Many studies have studied programmed learning, which is frequently produced spontaneously in an

attempt to modify traditional teaching techniques and ideas. The study's findings revealed that using programmed learning can help students assimilate instructional content more effectively and perform better academically.

Introduction. Programmed learning originated in the early 50s of the XX century, when the American psychologist B. Skinner proposed to improve the efficiency of management, and assimilation of material, building it as a consistent program for providing information and monitoring their assimilation. B. Skinner's notion of programmed learning suggests the use of machines to assist teachers in the classroom. The terms of behaviourism, such as stimulus, reaction, feedback, and reinforcement, serve as the foundation of this system. An incentive is a question or assignment that pupils must complete. The stimulus-response is a solution to the problem, which provides feedback that allows you to recognise the outcome of this step of learning [2; p. 155].

In the years thereafter, a truly huge amount of effort has been made in the field of information exchange concerning specific notions of programmed learning, as well as the results of studies. These objectives have been achieved via congresses, conferences, and congresses of specialists involved in programmed learning research, both within and outside the framework of particular states. For example, in England (1966, 1968, 1976) or Poland (1968, 1969), and internationally, in Czechoslovakia (1965, 1967, 1970), the Soviet Union (1964, 1961, 1968), the Federal Republic of Germany (annual congresses since 1963), and a UNESCO conference attended by representatives from 20 countries (Varna, 1968), including Poland. During these discussions, the earliest notions of programmed learning were critically evaluated. Discussions were held on the topic of the role of this training in the didactic system of modern schools, the fundamentals of so-called didactic programming were analysed, methodological principles of research conducted in this area were worked out, and in short, attempts were made to clarify the role of new learning technology in the holistic system of educational influences on students. Particular emphasis was placed on the notion that programmed learning is not limited to the classroom; it can also be applied in the military, industry, and other settings. In support of this assertion, the results of previous studies were presented, demonstrating the numerous benefits of adopting a "new technology" or "scientific organisation of the educational process" in this field. [3; p. 133].

Most modern textbooks and books are built on the premise of step-by-step knowledge presentation, with control and self-control built in through questions, activities, and exercises. The programmed printed guides allow students to navigate to different pages of the manual based on the correctness of their responses to the control questions. However, the logic of the subject may be violated in some programmed guides [3; p. 136]. According to B. Skinner, the training programme should be simple to use and free of obstacles for students. To do this, the programme is divided into discrete functions that allow for frequent feedback and reinforcement. At the same time, the proper answer to the problem should bring the learner satisfaction and happiness, which is reinforcement.

Programmed learning is defined as learning according to a pre-planned programme of actions that includes the actions of both students and the teacher. Programmed learning is defined in modern didactics as the controlled consumption of programmed educational content with the assistance of training equipment (computer, programmed textbook, movie trainer, etc.). Working in a programmed learning system gives the following results [4; p. 55]:

• individualization of learning and activation of students' independent work;

• constant self-examination, respectively, introspection;

• dividing tasks into small "steps" that are better assimilated;

• the program's tasks can be opened in any format: electronic or printed media, whichever is more convenient for the student.

There are currently three main models of programmed learning:

1. B.Skinner, an American psychologist created a *linear approach to programmed learning* in the early 1960s. based on the behavioural direction in psychology. He sees the main disadvantages of the classroom-based learning system in students' low activity, the lack of optimal rates of

academic work for each student, and the teacher and students' lack of awareness of the correct understanding and assimilation of the studied educational material. According to this system, students go through all the steps of the training program sequentially, in the order in which they are given in the program. The tasks in each step consist of filling in a gap in the information text with one or more words. After that, the learner must verify his decision with the correct one, which was previously closed in some way [5; p. 61]. If the student's answer was accurate, he must move on to the next step; if his answer did not match the correct one, he must repeat the procedure. Thus, the linear system of programmed learning is based on the learning principle, assuming error-free task execution. Therefore, the steps of the program and tasks are designed for the weakest student [6; p. 204].

2. The founder of the *branched program of programmed learning* is an American teacher N. Crowder. In these increasingly popular programmes, in addition to the primary programme developed for advanced students, other programmes (auxiliary branches) are available, to which a student is directed in the event of difficulty. Individualization (adaptation) of training is provided by branched programmes not only according to the rate of progress but also according to the level of difficulty. Furthermore, these programmes provide more opportunities for the development of rational types of cognitive activity than linear ones, which confine cognitive activity primarily to perception and memory [7; p. 90].

3. *Mixed (Sheffield) approach to programmed learning*. Teaching is only a complicated activity. As a result, opponents of the stated programming alternatives argue that it cannot be classified as "teaching through writing" or "teaching through guessing." It would be far more beneficial to incorporate both types of student reactions into a single whole, resulting in a more reasonable programme that is closer to the true process of educating people. This perspective is expressed in the effort to ensure the internal consistency of programmed learning with problem-based learning. The aim to combine linear branching programmes resulted in the development of mixed programming by British psychologists from the University of Sheffield. It is distinguished by the following characteristics:

• The training material is divided into parts of different volumes (portions, steps). The decisive grounds for separation for this are the didactic goal, which should be achieved through the study of this fragment of the programmed text, taking into account the age of students and the characteristic features of the topic. If, for example, a program was needed that is the only source of knowledge on this topic, then it should be broader than if it performs only a control or correctional function. In a program developed for elementary school students, the scope of the framework will usually be less than in texts for students. Finally, the meaningful and logical connections that exist between individual blocks of information determine a certain thematically closed set, the integral transmitted information, which also affects the scope of the framework in a mixed program.

• The learner responds by selecting them and filling in the spaces in the text. The didactic aim that the author of the programme seeks to achieve is the major factor determining which of the studied choices will be executed (i.e., the choosing of an answer or filling in the gaps). The Skinner principle of answer selection, for example, is primarily utilised in a corrective framework to help students accurately master the content they face again. Crowder's answer-choice approach is applied in the so-called basic framework, which encloses the most relevant information.

• The student cannot proceed to the following level, or step until he has thoroughly grasped the previous one's topic. This feature is shared by all didactic programming variations, but it is given extra weight in mixed programming since the creators of mixed programs allow for both individual and group interaction with the programmed material. According to the authors, the success of the latter is even more dependent on rigorous adherence to the provision in question than the success of individual work.

• The content of the separate frameworks is differentiated based on the student's abilities as well as their level of progress in learning this topic. With this provision in mind, a mixed programme is similar to a branching one, in which both the content and the pace of learning can be customised.

• The principle of differentiation of obstacles and the strength of knowledge obtained by pupils operates in mixed programming, as it does in linear and branching programming. Sheffield programming, for example, pays great emphasis to the notion of efficiency of students' understanding, as well as blending theory and practice in instruction [8; p. 128].

Several programming methods, as well as numerous learning machines and gadgets, were developed throughout the 1960s and 1970s when there was a significant deal of interest in programmed learning. Although not all of these concerns are valid, they do have a certain basis. Therefore, interest in programmed learning in the 70-80s of the twentieth century began to decline and its revival has occurred in recent years based on the use of new generations of computer technology [9; p. 16]. Modern technologies enable nearly complete automation of the learning process, resulting in an interactive dialogue between the learning system and the student. In this environment, the task of teachers is reduced to developing, adjusting, correcting, and improving the training programme, as well as implementing particular learning aspects that cannot be automated [10; p. 4].

The systematic review of Sadykov et.al [11; p.20] showed the following advantages of programmed learning:

- useful and satisfying than traditional educational techniques;
- proved the favourable effects of indirect behavioural processes work (response induction, stimulus generalisation) on behaviour development;
- extremely effective in the process of motor activity learning;
- a significant improvement in test scores for students in undergraduate and secondary education;
- increased pupils' interest;
- suitability for junior school;
- provided helpful features for students and teachers to use in lectures, exercises, or at home;
- positive effects and evidence that a combination of lab experiments.

In recent years, the issue of such principles of selection of material for programmed learning as scientific, accessibility, consistency, and connection with life, that is, the principles of selection of material for any educational program, has been discussed in detail. To increase the effectiveness of teaching through programmed learning tasks, the question of the selection of educational material for these very tasks should be put in the first place. We find a discussion of the selection of educational content in the works of V.P. Bespalko [12; p. 183], S. G. Shapovalenko [13; p.12.], Guła-Kubiszewska and Wieczorek [14; p. 74], Mukadam et.al [15. p. 145]. However, when choosing a material for programmed learning, you should pay attention not only to the logic of the text but above all to the planned assimilation. It should be formed in simple language and at the same time prove the assimilation of the material read [16; p. 155].

Various concepts of programmed learning supported by scientists have common features that characterize this form of organizational activity of a teacher in programmed learning:

- programmed learning is a type of independent work on tasks that form a program;
- the programs are created by teams of teachers under the guidance of scientists and are designed to teach different age groups in different academic subjects;
- the program largely replaces the teacher but does not completely exclude his participation in the educational process;
- to guarantee maximum control over the student's autonomous work, the programme should be composed of logically related steps, each of which includes a control question, the correct answer to which demonstrates comprehension and assimilation of the step's content. This provides feedback and allows you to proceed with only the correct response;

- the program can be delivered in the form of printed textbooks or teaching machines that transfer material to students.

It is critical to consider the following factors while organising and giving these lessons:

• The instructor must have extensive knowledge and skills in the methodology of these sessions.

• A teacher's capacity to diagnose students' knowledge levels, select relevant content, and develop a didactic process corresponding to a non-standard lesson is critical.

There are the following types of organizational activities in programmed learning:

1. Development of a programme of instruction is the process of creating a learning system, which includes planning, analysis of students' needs, material selection and structuring, development of teaching methods and technologies, and the creation of tasks and exercises that take into account subject area specifics and learning goals.

2. The process of integrating the designed programmed course into the educational process, including training organisation, method and form selection, and course adaption to unique learning situations, is referred to as course introduction.

3. Pedagogical support of training is the process of monitoring, supporting, and stimulating students' learning while using a training programme, which includes selecting methods and forms of work with students, analysing intermediate results, adjusting the educational process, and assessing the level of achievement of educational goals.

4. Didactic analysis of the effectiveness of the training course is the process of evaluating the achievement of educational goals and the effectiveness of the training course's use, which includes comparing actual learning outcomes to planned ones, analysing the causes of deviations, and making recommendations for further development and improvement of the training course [17; p. 177].

It is worth noting that several companies, universities and startups have been created in Kazakhstan, which are engaged in the development of programmed lessons and educational games [18]:

1. The Bilimland educational ecosystem was established in 2011 to develop multiple online learning platforms for children of all ages within the frameworks of preschool, school, and additional education. This ecosystem is built around a collection of digital teachings in the form of captivating videos and summaries, simulators and simulators, and interactive exercises of different complexity. More than 40,000 interactive lessons based on the school curriculum are available in the library. There are educational resources in Kazakh, Russian, and English. Virtual laboratories are available in physics, mathematics, chemistry, biology, and geography.

2. Edtech Kazakhstan" is a company that creates programs and applications for education in English for children and adults.

3. Astana IT University is a university that develops software for education based on artificial intelligence. They create intelligent systems to automate the learning process and adapt learning materials to the individual needs of each student.

4. EdCrunch is a company that develops software for education and creates online courses. They offer a wide range of services, from concept development to the creation of a finished product. One of their developments is the educational platform "iStudy".

5. Astana Hub is an international IT startup technopark that has been dubbed the home equivalent of the famous American Silicon Valley. Here, ideal conditions for the development of breakthrough technologies and businesses under the brand "Made in Kazakhstan" have been created. The Technopark is the heart and locomotive of Kazakhstan's innovation ecosystem development.

Based on many years of experience and research, it is apparent that programmed learning, particularly computer-based learning, contributes to achieving a high level of learning and development in students. It arouses unflagging interest because it allows students to actively interact with the material, adapt it to their needs and learn at their own pace. This leads to a deeper

assimilation of knowledge and the development of critical thinking. Therefore, the purpose of our work is to develop programmed chemistry lessons, as well as to test their effectiveness.

Materials and methods. The starting point for creating programmed lessons for the school level of education is a thorough analysis of the content and methods of the current chemistry curriculum. The analysis of the works of the above authors significantly contributed to the compilation of materials with the subsequent entry of data into the information database.

As part of the study, chemistry lessons were conducted on the presented topics from the section "15 groups of chemical elements". Calendar and thematic planning of programmed chemistry lessons are presented in Table 1.

Table 1. Calendar and thematic planning of programmed chemistry lessons

Lesson topics	**Lesson objectives**
Nitrogen. Laboratory experi-ment "Nitrogen molecule model"	- explain the properties of nitrogen and the nitrogen cycle in nature.
Ammonia. Laboratory experiment "Model of an ammonia molecule"	-explain the molecular, electronic and structural formulas of ammonia.
Properties of ammonia, preparation and application. Practical work "Obtaining ammonia and studying its properties". Ammonia production	-explain the production, properties and use of ammonia; -be able to obtain ammonia by reacting an ammonium salt solution with an alkali solution and investigate the properties of gaseous ammonia and its solution; -describe the ammonia production process.
Nitric acid. Laboratory experience "Properties of nitric acid common with other acids"	-know the molecular formula of nitric acid and explain the formation of chemical bonds between atoms; -to make up the equations of reactions for obtaining nitric acid from nitrogen; -to investigate the properties of nitric acid, common with other acids.
Specific properties of nitric acid and nitrates	-describe the specificity of the interaction of dilute and concentrated nitric acid with metals and be able to compose reaction equations; -explain the features of the thermal decomposition of nitrates, make equations.
Phosphorus and its compounds	-compare allotropic modifications of phosphorus; -to name the deposits of phosphorus compounds in Kazakhstan; -explain the general chemical properties of phosphorus and its compounds.

The study included two ninth grade classes, which were divided into two groups: 9 "B" was a control class, while 9 "A" was an experimental class.The study and approbation of new material in the control grade 9 "B" was done in the traditional format (without the use of programmed lessons); learning in the experimental grade 9 "A" was done using programmed lessons.

The goal of the work was to produce a simple non-procedural language that could be used by anyone, even those with no programming experience. As a result, the SQL programming language was chosen to construct a programmable chemical simulator that can be simply utilised by any teacher who is familiar with databases like Microsoft Access or even a non-relational Microsoft Excel database

SQLite is a relational database that saves data in a local file on your computer. It is small, fast, and dependable. It is widely used in web applications, desktop applications, and other fields, and is one of the most popular databases for mobile devices and integrated systems. There are numerous benefits to using SQLite when developing interactive programmed lessons for teachers:

For starters, SQLite has a fast reading and writing performance, allowing you to quickly retrieve and analyse massive volumes of data. This is especially critical when building interactive lessons with graphs, charts, tables, and other visualisation elements.

Second, SQLite is highly reliable and secure. In the event of a program failure, the database may automatically build data backups and preserve data integrity. This is especially true when employing interactive classes that may contain a considerable quantity of user data, such as test answers, grades, and so on.

Third, SQLite provides a large range of methods that can be utilised for developing interactive lessons, such as running SQL queries to get data, defining relationships between tables, using transactions, and so on.

Finally, the use of SQLite provides easy integration of the database with other technologies, such as Python, JavaScript and others, which can simplify the development and support of interactive lessons [19; p. 667].

To create a new SQLite database, you need to enter the "Database — Add Database" menu. To create a table, the menu opens (Figure 1) "Structure — Create a table". The structure window appears. Then you need to enter the name of the structure. After that, the fields appear (Figure 2), where the compiled material for the lesson is entered.

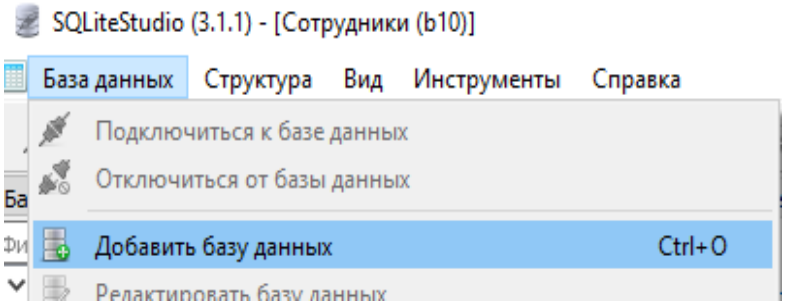

Figure 1. Adding a new database to SQLite studio

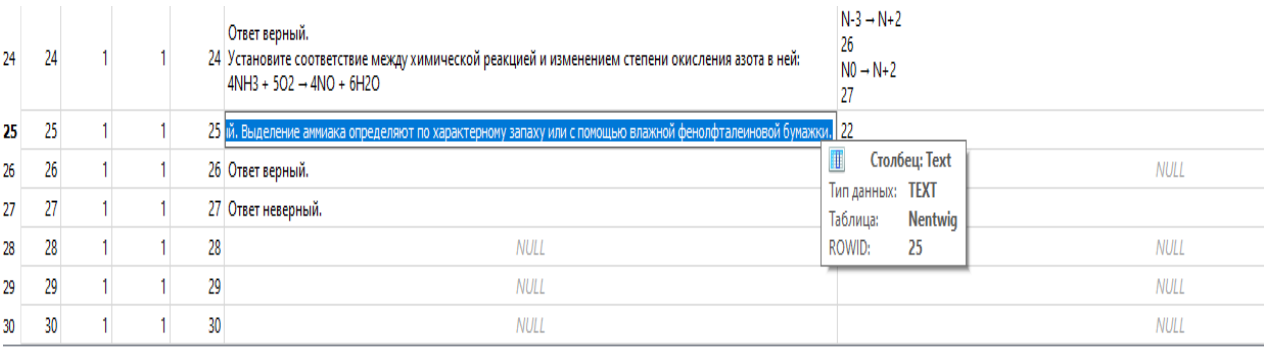

Figure 2. Example of a new SQLite studio table

It is necessary to use extreme caution when numbering and populating links in the SQLite database graph. The following algorithm creates the record's logic: For each question with two possible answers, three lines ("Chapter") are required in the "Text" column, with the first line being the text of the question itself, the second being an incorrect answer with explanations, the third being correct, which will redirect to the next question and, accordingly, the fourth line (Figure 3).

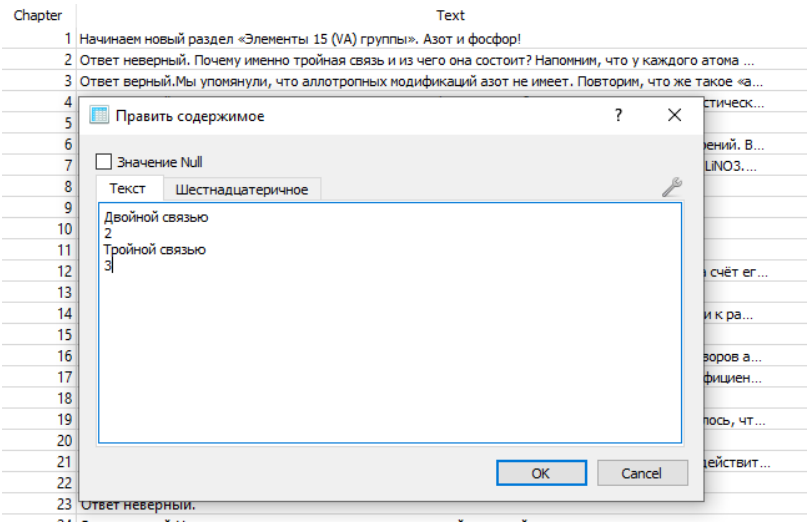

Figure 3. The logic of entering one question with two possible answers into the rows of the SQLite studio table

It is required to register links after each answer in order for the programme to route the test taker to the answers. As demonstrated in the examples (Figures 4-5), the first row of the "Answers" column has links to the second and third rows of the "Text" column, respectively, and the second row (incorrect answer) contains a link to the first row of the "Text" column. Anyone with no programming skills or understanding of programming languages can easily design their own interactive test using this algorithm.

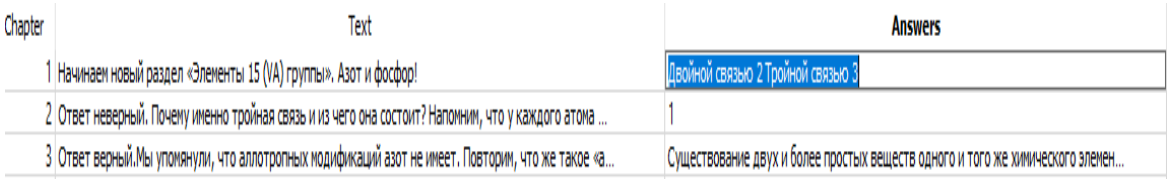

Figure 4. Example of filling in the "Answers" column of the SQLite studio table

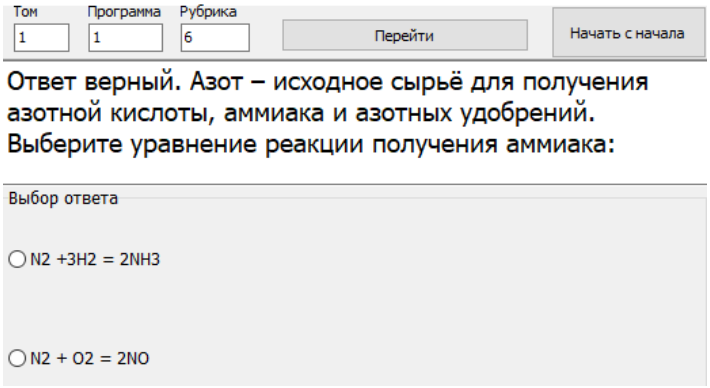

Figure 5. Example of a question with two possible answers

The following reasons justify utilising the proposed methodology to create a system of programmed training tasks:

1. Question logical sequence: The scenario is built on a network of logically consistent questions, which contributes to the task's progressive complexity. This method allows students to

gradually deepen their knowledge and skills, beginning with simple principles and progressing to more complicated features.

2. Textbook-based methodology: The methodology is based on the text of the textbook being studied. This enables you to connect activities to finished training material, resulting in a deeper comprehension and mastery of the subject.

3. Variability of answers: Selecting the correct answer advances you to the next section, whilst selecting the erroneous response returns you to the previous section, where the explanation for the error is given. This provides a feedback loop, allowing pupils to learn from their mistakes and expand their knowledge.

It should be emphasised that the use of programmed tests with two response possibilities allows students to access the content using cell phones or other electronic resources while they are not connected to the internet. This allows students to have more flexible access to information and the ability to repeat tests to solidify knowledge. Because each student can choose a convenient time and location for completing the test, autonomy also adds to the individualization of learning. In general, the proposed methodology, which employs a network of logically consistent questions with a range of responses and the feedback principle, provides structured and interactive learning, promoting deep knowledge and active assimilation of instructional material.

Result and Discussion. The entrance testing was participated in by 28 students from the 9th "A" (experimental) class and 26 students from the 9th "B" (control) class. The same entrance test was designed for all classes.

Based on the results of the experimental class's entrance testing: 1-4 points were received by 8 students, which is 28% of the total number of students in the class, 5-6 points were received by 4 students, which is 14%, and 16 students received 7-10 points, which is 57%. The average percentage of assimilation of learning content is 61%.

As a result of the entrance testing in the control class, the following results were revealed: 6 students received from 1 to 4 points, which corresponds to a low level of assimilation of educational material and accounts for 23% of the total number of students in the class. 7 students scored 5-6 points, which is 27%. 16 students demonstrated a high level of academic performance, receiving from 7 to 10 points, which is 50%. The average rate of assimilation of educational material was 62.3%.

The developed programmed lessons on the topics: «Nitrogen», «Properties of ammonia, preparation and application», «Nitric acid», «Specific properties of nitric acid and nitrates», «Phosphorus and its compounds» were conducted in an experimental classroom.

The same final test was designed for all classes. After that, 28 students from the 9th "A" (experimental) class and 26 students from the 9th "B" (control) class participated in the final testing (diagram 1).

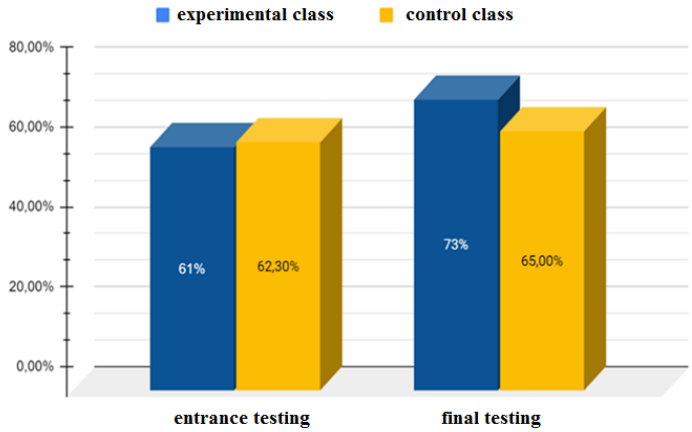

Diagram 1. Results of entrance and final testing in experimental and control classes

According to the results of the final testing in the experimental class, the following results were obtained: 3 students received an assessment level of 1-4 points, which corresponds to insufficient assimilation of educational material and is 10% of the total number of students in the class. A score of 5-6 points was received by 6 students, which is 21%. Great success was demonstrated by 19 students who received a score of 7-10 points, which is 57%. The average value of learning material assimilation was 73%.

The final testing in the control class revealed the following results: 2 students received an assessment level of 1-4 points, which corresponds to low assimilation of educational material and is 8% of the total number of students in the class. 9 students received a score of 5-6 points, which is 34%. Significant success was demonstrated by 15 students who received a score of 7-10 points, which is 58%. The average rate of assimilation of educational material was 65%.

The test results demonstrate the dynamics of academic achievement growth. The results clearly show the effectiveness of using the recommended programmed lessons. Pay attention to the data in diagram 1; there is a 12% increase in the average value of assimilation of educational material, particularly in the experimental class. The findings clearly show that programmed lessons help to improve the quality of students' learning by making classes more meaningful, visual, and accessible. These classes not only give pupils new knowledge, skills, and talents but also help them fix them. They cause students to become interested in studying subjects, and develop their analytical, synthetic, generalizing, comparing and classifying abilities, thereby stimulating their cognitive activity in the classroom.

Survey results. Following the completion of the final testing, a questionnaire was conducted in the experimental grade 9 "A". According to the study [20; p. 110], we have developed our questionnaire to study the students' opinions based on programmed instruction during six chemistry lessons. The questionnaire used in this research consisted of ten closed-ended questions:

1. Do you like lessons using programmed tasks?
2. Do you think that programmed lessons are more interesting than traditional lessons?
3. Was the explanation in the lesson clear enough to understand the topic well?
4. Do you think that the knowledge gained in chemistry lessons will be useful to you in life?
5. Have the knowledge gained in a programmed chemistry lesson been applied in real life?
6. Would you like such lessons to be held more often?
7. Were you interested in solving problems using a mobile phone or tablet?
8. Do you think that solving problems in this way is more interesting than the traditional method?
9. Would you like such programmed problems in chemistry to be solved more often?
10. Do you feel that programmed chemistry lessons help to memorize and assimilate new concepts and concepts?

A three-level rating scale from 1 to 3 (1 - Agree, 2 - Neutral, 3 – Disagree) was chosen as the most appropriate for measuring participants' opinions (diagram 2).

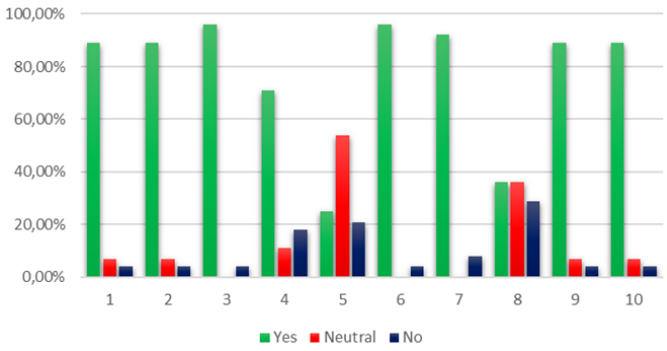

Diagram 2. Results of the survey in the experimental 9th "A" class

Question 1: 25 students (about 89%) answered «Yes», 2 students (about 7%) found it difficult to answer, and 1 student (about 4%) answered «No». This suggests that most students like lessons using programmed tasks.

Question 2: Once again, 25 students (about 89%) answered «Yes», 2 students (approximately 7%) found it difficult «neutral», and 1 student (approximately 4%) answered «No». This suggests that most students prefer programmed classes to traditional ones.

Question 3: 27 students (about 96%) answered "Yes", and 1 student (about 4%) answered «No». This suggests that most students believe that the explanation in the programmed lesson was clear enough for a good understanding of the topic.

Question 4: The students' answers differ slightly here. 20 students (about 71%) said «Yes», 3 students (around 11%) said it was «neutral», and 5 students (roughly 18%) said «No». This could imply that some students do not see or have difficulties applying the knowledge learned from programmed chemical lessons in real life.

Question 5: There is a greater divergence of opinion here. 7 students (about 25%) answered «Yes», 15 students (about 54%) found it difficult to answer, and 6 students (about 21%) answered «No». This suggests that a significant part of the students doubt whether the knowledge gained in chemistry lessons will be useful in their lives.

Question 6: 27 students (about 96%) replied «Yes», whereas 1 student (approximately 4%) answered «No». This suggests that the majority of students would prefer to attend the programmed lessons more often.

Question 7: All 28 students (100%) answered «Yes», which indicates that they were interested in solving problems using a mobile phone or tablet.

Question 8: Here the results are more diverse. 10 students (about 36%) answered «Yes», 10 students (about 36%) found it «neutral», and 8 students (about 29%) answered «No». This indicates that the student's opinion that solving problems using a mobile phone or tablet is more interesting than the traditional method is distributed more evenly.

Questions 9-10: 25 students (about 89%) answered «Yes», 2 students (about 7%) found it difficult to answer, and 1 student (about 4%) answered «No». This suggests that most students would like chemistry problems to be solved more often.

According to the survey findings, students in the 9th "A" class found programmed chemistry lessons utilising computer and mobile devices to be fascinating and beneficial. The majority of students appreciated the clarity of the explanations in the lessons and expressed a wish to have more programmed classes and solve difficulties using new technology.

Conclusion. Programming instruction has several undeniable advantages: small doses are easily absorbed, the pace of assimilation is chosen by the student, high results are provided, rational ways of mental actions are developed, and the ability to think logically is brought up.

The study of the outcomes of the application of programmed chemistry lessons in the experimental class indicated a significant increase in the average value of educational content assimilation by 12% (in comparison to the input testing). This finding emphasises the fact that the pedagogical technique of programmed learning allows you to transform regular chemistry lessons into educational ones. This improvement in the assimilation of educational material can be attributed to the active participation of students through interactive teaching methods and technology tools that boost interest and motivate them to learn.

The results of the survey provide information about the degree of reflection of students, which can help in the development of effective strategies and teaching methods. It follows from the results of the survey that the majority of students (about 89%) positively assess the programmed chemistry lessons and consider them more interesting compared to traditional teaching methods. They also believe that the explanations in such lessons were understandable (about 96%). The majority of students expressed a desire to conduct programmed lessons and solve problems using modern

technologies (about 89%). These results indicate a positive attitude of students toward programmed chemistry lessons.

Our experience with the use of programmed learning technology in chemistry classrooms has shown that this strategy produces positive outcomes and stimulates the growth of student involvement. Non-standard lessons allow students to put themselves to the test, and check and evaluate themselves independently, all of which help to the development of cognitive activity in chemistry courses. We propose to use programmed learning methods more widely when studying chemistry courses: to increase the efficiency of their use in studying general laws of chemistry, the use of substances, and the genetic relationship between different classes of inorganic compounds; to study the properties and patterns of individual classes of substances, which will contribute to faster memorization and assimilation; and to clarify the structure of substances, which allows a deeper understanding of the relationship between the composition and properties of various classes of organic and inorganic compounds.

The results of our work confirm the importance of integrating modern educational technologies into the educational process and allow us to conclude that the use of programmed teaching methods can contribute to a more effective assimilation of educational material and improve student academic performance. It should be mentioned that larger research with a greater number of students and consideration of other elements that may affect the learning process is recommended for more generalised and accurate conclusions.

However, programming training has several drawbacks, including:

• it takes a long time;

• it is only applicable to algorithmically solvable cognitive tasks;

• excessive algorithmization of learning hinders the formation of productive cognitive activity.

To solve these shortcomings, we consider it necessary to fulfil the following requirements:

1. When teaching, the learner must follow a well-designed and placed sequence of steps.

2. Training should be designed in such a way that the student is "busy" all of the time so that he not only perceives but also operates with the instructional information.

3. Before continuing to the next material, the learner must thoroughly master the previous one.

4. The student should be assisted by dividing the educational material into short pieces including information, clues, and rewards.

5. Each correct answer of the student should be reinforced, utilising feedback not only to clarify the student's level of knowledge but also to retain enthusiasm for learning.

References:

1. Официальный сайт общества с ограниченной ответственностью «EdCrunch Academy» [Электронный ресурс]. – 2023. – URL: https://www.edca.kz/ (Режим доступа:25.05.2023).

2. Селевко Г.К. Педагогические технологии на основе активизации, интенсификации и эффективного управления УВП. М.: НИИ школьных технологий, 2005. – 288 с.

3. Zendler A., Reile S. The effect of reciprocal teaching and programmed instruction on learning outcome in computer science education // Studies in Educational Evaluation. – 2023. – № 58. – P. 132–144.

4. Lee V. S. Teaching and Learning through Inquiry. Sterling: V.A. Stylus Publishing, 2004. – 222 p.

5. Lockee B. B., Moore D. M., Burton, J. K. Old concerns with new distance education re-search // Educause Quarterly. – 2004. – № 24. – P. 60–62.

6. Oginni O.I., Owolab O. Integration of programmed instruction into mathematics and science teaching: a panacea to students dwindling interest in mathematics and science in Nigerian schools // European Journal of Educational Research. – 2012. – № 3 (1). – P. 199-209.

7. McDonald J.K. Yanchar S.C., Osguthorpe R.T. Learning from programmed instruction: Examining implications for modern instructional technology // Educational Technology Research & Development. – 2005. – № 53 (2). – P. 84–98.

8. Marson SN. Programmed instruction-panacea or passing gimmick? A report on the introduction of programmed instruction into nurse training schools in the Sheffield region // Int Nurs Rev. –1972. – №19(2). – P. 126-139.

9. Kurbanoglu N.I., Taskesenligil Y., Sozbilir. M. Programmed instruction revisited: a study on teaching stereochemistry // Chemistry education research and practice. – 2006. – № 7 (1). – P. 13–21.

10. Sadykov T., Čtrnáctová H. Application interactive methods and technologies of teaching chemistry // Chemistry Teacher International [Electronic resource]. – 2019. – URL: https://www.degruyter.com/view/j/cti.ahead-of-print/cti-2018-0031/cti-2018-0031.xml?format=INT (accessed:25.05.2023).

11. Sadykov T., Kokibasova G., Minayeva Y., Ospanova A., Kasymova M. A systematic review of programmed learning approach in science education // Cogent Education, 10:1 [Electronic resource]. – 2023. – URL: https://doi.org/10.1080/2331186X. 2023.2189889 (accessed:16.04.2023).

12. Беспалько В.П. Программированное обучение. Дидактические основы. -Москва: Высшая школа, 1970. – 300 с.

13. Шаповаленко С.Г. Методика обучения химии в восьмилетней и средней школе. (Общие вопросы). Пособие для учителей, 1963. – 244 с.

14. Guła-Kubiszewska H., Wieczorek M. Programované učení v procesu motorického učení [Programmed learning in the process of motor learning] // Acta Univ. Palacki. Olomuc. – 2004. – № 34 (2). – P. 71–77.

15. Mukadam P., Vyas S., Nayak H. Skinner's Programmed Learning vs. Conventional Teaching Method in Medical Education: A Comparative Study // National Journal of Community Medicine.–2014.– №5(1).– P.144–147.

16. Гриценко В.И. Сущность информационных технологий / В.И. Гриценко. - М: Просвещение, 2006. – 354 с.

17. Четтыкбаев Р.К. Вопросы компьютеризации учебного процесса // Вестник КАСУ. – 2008. – №1. – С.176– 180 с.

18. Электронные образовательные платформы [Электронный ресурс]. – 2021. – URL: https://ineu.edu.kz/obuchayushchimsya/544-jelektronnye-obrazovatelnye-platformy.html (Режим доступа:25.05.2023).

19. Дейт К. Дж. Введение в системы баз данных / Пер. с англ. – 8-е изд. – М.: Вильямс, 2005. – 1328 с.

20. Sadykov, T., Ctrnactova, H., & Kokibasova, G.T. Students' opinions toward interactive apps used for teaching chemistry // Bulletin of the University of Karaganda – Chemistry. – 2021. – № 103(3). – P. 103-114.

References:

1. Oficial'nyj sajt obshchestva s ogranichennoj otvetstvennost'yu «EdCrunch Academy» [Elektronnyj resurs]. – 2023 – URL: https://www.edca.kz/ (accessed:25.05.2023).

2. Selevko G.K. Pedagogicheskie tekhnologii na osnove aktivizacii, intensifikacii i effektivnogo upravleniya UVP. M.: NII shkol'nyh tekhnologij, 2005. – 288 s.

3. Zendler A., Reile S. The effect of reciprocal teaching and programmed instruction on learning outcome in computer science education // Studies in Educational Evaluation. – 2023. – № 58. – P. 132–144.

4. Lee V. S. Teaching and Learning through Inquiry. Sterling: V.A. Stylus Publishing, 2004. – 222 p.

5. Lockee B. B., Moore D. M., Burton, J. K. Old concerns with new distance education re-search // Educause Quarterly. – 2004. – № 24. – P. 60–62.

6. Oginni O.I., Owolab O. Integration of programmed instruction into mathematics and science teaching: a panacea to students dwindling interest in mathematics and science in Nigerian schools // European Journal of Educational Research. – 2012. – № 3 (1). – P. 199–209.

7. McDonald J.K. Yanchar S. C., Osguthorpe R.T. Learning from programmed instruction: Examining implications for modern instructional technology // Educational Technology Research & Development. – 2005. – № 53 (2). – P. 84–98.

8. Marson SN. Programmed instruction--panacea or passing gimmick? A report on the introduction of programmed instruction into nurse training schools in the Sheffield region // Int Nurs Rev. –1972. – №19(2). – P. 126-139.

9. Kurbanoglu N.I., Taskesenligil Y., Sozbilir. M. Programmed instruction revisited: a study on teaching stereochemistry // Chemistry education research and practice. – 2006. – № 7 (1). – P. 13–21.

10. Sadykov T., Čtrnáctová H. Application interactive methods and technologies of teaching chemistry // Chemistry Teacher International [Electronic resource]. – 2019. – URL: https://www.degruyter.com/view/j/cti.ahead-of-print/cti-2018-0031/cti-2018-0031.xml?format=INT (accessed:25.05.2023).

11. Sadykov T., Kokibasova G., Minayeva Y., Ospanova A., Kasymova M. A systematic review of programmed learning approach in science education // Cogent Education, 10:1 [Electronic resource]. – 2023. – URL: https://doi.org/10.1080/2331186X. 2023.2189889 (accessed:16.04.2023).

12. Bespal'ko V.P. Programmirovannoe obuchenie. Didakticheskie osnovy. - Moskva: Vysshaya shkola, 1970. – 300 s.

13. Shapovalenko S.G. Metodika obucheniya himii v vos'miletnej i srednej shkole. (Obshchie voprosy). Posobie dlya uchitelej, 1963. – 244 s.

14. Guła-Kubiszewska H., Wieczorek M. Programované učení v procesu motorického učení [Programmed learning in the process of motor learning] // Acta Univ. Palacki. Olomuc. – 2004. – № 34 (2). – P. 71–77.

15. Mukadam P., Vyas S., Nayak H. Skinner's Programmed Learning vs. Conventional Teaching Method in Medical Education: A Comparative Study // National Journal of Community Medicine. – 2014. – № 5 (1). – P. 144–147.

16. Gricenko V.I. Sushchnost' informacionnyh tekhnologij / V.I. Gricenko. - M: Prosveshchenie, 2006. – 354 c.

17. Chettykbaev R.K. Voprosy kompiuterizatsii uchebnogo protsessa // Vestnik KASU. – 2008. – №1. – C.176– 180 s.

18. Elektronnye obrazovatelnye platformy [Elektronnyi resurs]. – 2021. – URL: https://ineu.edu.kz/ obuchayushchimsya/ 544-jelektronnye-obrazovatelnye-platformy.html (Rezhim dostupa:25.05.2023).

19. Dejt K. Dzh. Vvedenie v sistemy baz dannyh / Per. s angl. – 8-e izd. – M.: Vil'yams, 2005. – 1328 s.

20. Sadykov, T., Ctrnactova, H., & Kokibasova, G.T. Students' opinions toward interactive apps used for teaching chemistry // Bulletin of the University of Karaganda – Chemistry. – 2021. – № 103(3). – P. 103-114.

IRSTI 14.25.09 https://doi.org/10.51889/2959-5762.2024.82.2.029

Tkach G.,[1,2] Li O.[2], Kerymbayev N.,[1] Garvanov I.[3]*

[1] Al-Farabi Kazakh National University, Almaty, Kazakhstan
[2] Toraigyrov University, Pavlodar, Kazakhstan
[3]University of Library Studies and Information Technologies, Sofia, Bulgaria

AUGMENTED REALITY AS A WAY TO PRESENT EDUCATIONAL CONTENT IN THE MOBILE APPS

Abstract

This article deals with the issue of implementing the capabilities of augmented reality in learning mobile applications, which is very topical for modern education. The aim of the article is to consider the application of augmented reality in the learning content of mobile applications. This article is devoted to the main aspects of the educational mobile technologies and practical application of the research results in the educational process of the general education institutions. The article deals with the application of the educational content of the mobile application module with the application of augmented reality on the example of teaching the subjects "Informatics" and "Digital literacy" in the secondary general education schools of the Republic of Kazakhstan. The basic definitions associated with educational mobile applications and augmented reality technology are given, an analysis of the subject area is carried out. The international experience of applying this technology in the educational process is considered. The stages of studying the subjects "Informatics" and "Digital Literacy" using mobile technologies of educational direction, such as mobile applications for the organization of the learning process and assessment of knowledge, skills and abilities of students are described. As a result of the experiment, the mobile application was practically realized and the adapted author's program "Application of mobile technologies at the lessons of informatics and digital literacy" was developed. The received results of application of mobile technologies in studying of a school course of computer science and digital literacy confirm the relevance of the carried out research.

Keywords: mobile technology, augmented reality, learning content, computer science, mobile applications, education.

Г.М. Ткач, [1,2] О.С. Ли,[2] Н.Н. Керімбаев, [1] И.Гарванов [3]*

[1] Әл-Фараби атындағы Қазақ ұлттық университеті, Алматы қ., Қазақстан
[2] Торайғыров университеті, Павлодар қ., Қазақстан
[3]Кітапханатану және ақпараттық технологиялар университеті, София қ., Болгария

МОБИЛЬДІ ҚОСЫМШАЛАРДА БІЛІМ БЕРУ МАЗМҰНЫН ҰСЫНУ ТӘСІЛІ РЕТІНДЕ ТОЛЫҚТЫРЫЛҒАН ШЫНДЫҚ

Аңдатпа

Бұл мақалада қазіргі заманғы білім беру үшін мобильді қосымшаларға толықтырылған шындық мүмкіндіктерін енгізу мәселесі қарастырылады. Мақаланың мақсаты мобильді қосымшалардың оқу мазмұнында толықтырылған шындықты қолдану мәселесін қарастыру болып табылады. Жұмыс білім берудегі мобильді технологияларының негізгі аспектілерін және жалпы білім беретін мекемелердің оқу үдерісінде зерттеу нәтижелерін практикалық қолдануды қарастыруға арналған. Мақалада зерттеу барысында әзірленген