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# ON THE EFFECTIVENESS OF USING AN ELECTRONIC TEXTBOOK IN FORMING THE READINESS OF FUTURE PRIMARY TEACHERS FOR INTEGRATED LEARNING

**Abstract:** The article presents a theoretical review and experimental study of the problem of using an electronic textbook in the process of developing the readiness of primary education teachers for integrated learning. The aim of the article is to determine the effectiveness of the electronic textbook in the process of developing the readiness of future teachers for the integrated education of primary schoolchildren.

The research materials were tested during the 2023-2024 academic year on the basis of the Pavlodar Pedagogical University named after Alkey Margulan, where 78 students of the educational program "Pedagogy and Methods of Primary Education" were involved at the stage of testing and implementation of the electronic textbook. To achieve the goal of the study, theoretical (analysis, synthesis, generalization and systematization of scientific publications) and empirical (testing, pedagogical experiment, expert assessment) methods were used. The validity of the results of experimental pedagogical work was confirmed using the methods of mathematical statistics - the Pearson criterion.

The educational results of the participants in the experimental pedagogical work demonstrated the obvious effectiveness and significance of the developed and tested electronic textbook, the content of which ensured the completeness and systematic assimilation of theoretical knowledge and the development of practical skills of students in the educational program "Pedagogy and Methods of Primary Education" for the successful implementation of integrated education for junior schoolchildren.

**Keywords:** integration, integrated learning, electronic textbook, readiness of future primary school teachers, digital resources in teaching, integrated learning for primary schoolchildren.

## Introduction

For the first time in the field of higher education, the demand for electronic learning tools increased during the COVID-19 pandemic, when physical access to many libraries was sharply limited and in these conditions electronic books, textbooks and other educational materials on electronic media acquired the importance of the first necessity, providing access to educational resources (Wells D., & Sallenbach A., 2023). Along with this, the universal digitalization of education aimed at using applications, programs and other digital learning tools in schools, universities, distance learning courses has become particularly relevant, and as a result, electronic educational resources and automated learning systems have become in demand, which can be used at every stage of education at the university, orienting teachers to flexibly build the learning process.

Within the framework of the problem under study, the key concept is “electronic textbook”, which is defined:

- as an electronic digital resource that allows you to increase the effectiveness of learning, using text, hyperlinks with tasks, audio files, educational video files (Ovchinnikova, 2023);

- as a specific system that contains educational information specially selected according to the appropriate structure, training and control exercises aimed at updating, comprehending, memorizing material, which are implemented through computer programs (Ovsjannikova, 2022);

- as software created at a high methodological level, fully consistent with the work program of the discipline (Germanovich, 2021).

Analysis of various approaches to defining the essence of the concept of “electronic textbook” made it possible to identify its practice-oriented orientation, which is manifested in the fact that students, after successfully mastering the content of the theoretical part of the electronic textbook, can work on the acquired knowledge and skills in its practical part.

The relevance of using an electronic textbook in the process of developing the readiness of primary education teachers for integrated learning lies in the social need to improve the quality of education and the development of intellectual abilities of students in the modern information community. The search for directions for increasing the effectiveness of professional development of future primary school teachers’ readiness for integrated learning is due to various educational and digital trends, the transition from a model of knowledge accumulation to a model of continuous use of knowledge. The use of an electronic textbook in the educational process of a university promotes the active use of digital education opportunities.

Let us turn to the available modern foreign works on the research problem. Thus, in the work of (Reinhold et.al, 2020), it is noted that the use of an electronic textbook contributes to a better and more systematic performance of academic tasks, namely, about 20% of teaching time is saved than with the traditional use of lesson form. By saving time, there is a real opportunity to increase the density of the lesson and enrich it with new content.

As studies by American scientists (Rockinson-Szapkiw et.al, 2013) show, the use of electronic textbooks in teaching can reduce the use of paper materials, which in turn contributes to the conservation of natural resources and environmental sustainability in the world.

Researchers (Alhammad et.al, 2019) note that electronic textbooks contribute to the development of information literacy, activate the learning process, and are an effective teaching tool at any stage of the lesson, helping the teacher make the lesson more interesting, accessible and effective.

Researchers (Kudumovic et.al, 2018) believe that the use of electronic textbooks in teaching can lead to revolutionary changes in education and its further development. According to scientists, electronic textbooks have ample opportunities for individualizing learning, allow you to adapt the material to the student’s level of preparation, and provide additional materials and tasks to expand knowledge and skills. Thus, each teacher can work at his own pace and at his own level, increasing his readiness for future professional activities.

Researcher (Vorotnykova, 2019) agrees with this same point of view, she has determined the organizational, psychological and pedagogical conditions for the use of electronic textbooks in school, these include:

- organization of lesson activities based on digital educational resources;
- training teaching staff to use elements of e-learning;
- motivational support for students;
- feedback.

All these conditions are interdependent for the effective use of electronic textbooks in educational institutions, create a favorable educational environment, develop information and

communication skills of students and improve the quality of education.

In (Tlili et.al, 2022) presents the results of the study, which showed that the development and implementation of e-textbooks varies among countries, which requires increased international cooperation to facilitate the implementation of e-textbooks throughout the world. In addition, the authors identified shortcomings in the use of electronic textbooks in education, such as eye fatigue and lack of knowledge about the use of electronic textbooks in education among both students and teachers. Therefore, the authors suggest more strategies for designing and teaching the use of electronic textbooks to improve both teaching and learning experience.

The study by (Shalgimbekova et.al, 2024) notes that the quality and performance of students is influenced by the choice of teaching tool. The authors conducted a quasi-experimental study in which the advantages of an electronic textbook were identified that positively affect the development of students:

- multimedia elements (video, audio, animation) help to better assimilate material due to the involvement of different sensory channels;
- the ability to adapt educational materials to the individual needs and level of training of each student;
- the ability to quickly search for information for an in-depth study of a topic.

It should be noted that digital technologies are used in almost all areas of educational activity, performing a wide range of tasks. Thus, in the work of researchers (Ongarbayev et.al, 2021) considers the problem of developing electronic educational resources. The authors believe that an important part of the training of future teachers is practical exercises, during which students can directly create their own electronic educational resources. This allows them to apply the acquired knowledge in practice, test their skills and evaluate the effectiveness of the educational materials they create.

An electronic textbook is not an alternative, but rather serves as an addition to various forms of lessons (Phan et.al., 2020). A number of American scientists (Chavali et.al., 2022) note that electronic textbooks are becoming popular among students at all levels of education, especially at the university level. Scientists have determined that electronic textbooks make it possible to adapt the material to the individual needs and capabilities of each student. This resource can provide additional information, highlight key concepts, or offer additional tasks for students of different skill levels. This helps to maintain an individual approach to each student and helps to overcome the difficulties encountered in the learning process.

We find an analysis of electronic textbooks as a means of modern education in the study of Kyrgyz scientists (Zulpukarova et.al., 2022) who emphasize the importance of electronic textbooks that can be used at the following stages of a lesson at a university:

- when studying new material;
- at the stage of consolidating and generalizing the acquired knowledge;
- independent study of theoretical material and development of practical skills.

The authors examined the capabilities of digital tools such as: “TurboSite”, “SunRav BookEditor”, “Flipsnack”, with the help of which you can create electronic manuals of any complexity with graphic and video capabilities.

Thus, the research results significantly complement and expand knowledge about the use of electronic textbooks in the educational process of a university, providing students with access to information and interactive materials.

Let us analyze the identified problem in modern Kazakhstani studies. In the context of informatization of education, one of the means of individualizing the educational activities of students at a university is the use of active digital tools (Seri, 2020). The effectiveness of this process depends on digital educational content, including electronic textbooks. The study by (Tazhigulova et.al., 2019) studied the trends in the development of electronic textbooks, presented the results of their implementation in real school practice, and also revealed their

effectiveness. The authors believe that the trend in the development of digital educational content in Kazakhstan and abroad is sustainable, which corresponds to the challenges of media education.

It should be noted that modern electronic learning technologies create a favorable environment for the development of students' cognitive processes. Within the framework of government programs, the use of electronic textbooks is regulated and special platforms for online learning are created (Samuratova, 2023).

Researchers (Seitnur et.al., 2022) reviewed the stages and process of developing an electronic textbook with animation; according to the results of their work, electronic textbooks contribute to better assimilation of educational material, increase interest in learning and develop research abilities in students. The results of the research of the above-mentioned scientists allow teachers to improve the methods and forms of presentation of educational material and demonstrate complex elements of learning in the form of animation.

Summarizing the experience of scientists on the research problem, we came to the conclusion that electronic textbooks provide an opportunity to individualize the educational process, adapting materials to the needs of specific groups of students. In addition, teachers can track progress and evaluate student performance using special functions of electronic textbooks. It should be noted that electronic textbooks cannot completely replace traditional teaching, being only a tool that complements the classical educational process; therefore, it is important to implement an integrated approach, combining various methods and teaching aids.

The problem of our research is to identify the influence of electronic means and determine the effectiveness of the electronic textbook in the process of developing the readiness of future primary school teachers for integrated learning. The solution to this problem was reflected in the development of an electronic textbook and testing its effectiveness in the process of developing the readiness of future teachers for integrated learning in primary school.

**Purpose and objectives of the study**

The purpose of the study was to determine the effectiveness of using an electronic textbook in shaping the readiness of future teachers for integrated learning in primary school.
The implementation of the designated goal involves solving the following tasks:
1) Analysis of scientific literature on the problem of using an electronic textbook in the pedagogical process of educational institutions.
2) Development, implementation and testing of the electronic textbook "Implementation of an integrated approach in teaching junior schoolchildren".
3) Experimental verification of the effectiveness of using an electronic textbook in shaping students' readiness to implement integrated learning in primary schools.
4) Comparison of the results of perception of educational information on integrated education for primary schoolchildren from traditional and electronic textbooks.

The objectives of the research are implemented in the content of university training of students, therefore there is a need to form a hypothesis:

1) According to the null hypothesis (H0), the distribution of levels of readiness of future teachers for integrated learning in primary school in the control and experimental groups does not differ at the control stage of the experiment.

2) The alternative hypothesis (H1) assumes the presence of positive changes in the levels of readiness of future teachers for integrated learning in primary school in the control and experimental groups, at the control stage of experimental teaching work, since students will be involved in activities aimed at mastering the body of knowledge, skills of integrating scientific knowledge in teaching primary schoolchildren.

**Methods and organization of the study**

To achieve the research goal, the following methods were used:

- theoretical (analysis, synthesis, generalization and systematization of scientific publications);
- empirical (testing, pedagogical experiment, expert assessment).

Experimental pedagogical work was carried out during the 2023-2024 academic year at Pavlodar Pedagogical University named after. A. Margulan. Using a random sampling method, two groups were formed: control and experimental. At the first stage, the sample consisted of 32 students, at the second stage - 46 students of the educational program "Pedagogy and Methods of Primary Education". The total sample size was 78 students, dual form of education.

The validity of the research results was confirmed using the method of mathematical data statistics - the Pearson criterion. To determine the level of readiness of future primary school teachers for integrated learning, student testing was used, the content of which was developed on the basis of research by (Sukharevskaya, 2013).

The level of preparedness of future primary school teachers for integrated learning was measured using the expert assessment method.

**Results and Discussion**

In order to form theoretical knowledge and develop practice-oriented skills in organizing integrated education in primary school, we created and tested an electronic textbook for future primary school teachers "Implementation of an integrated approach in teaching junior schoolchildren", for which we received a certificate of entry of information in the state register of rights to objects protected by copyright.

The electronic textbook "Implementation of an integrated approach in teaching junior schoolchildren" was created in the Macromedia Flash 8 development environment, which was used to create interactive web applications that allow the creation of multimedia content.

ActionScript is a programming language that was used to write scripts and create interactive elements in Flash. It made it possible to control animation, handle user events, and interact with server applications.

The use of these technologies to create an electronic textbook allowed:

- use animations to visually represent complex tasks in training;
- use audio and video materials, which contributed to the variety of presentation of educational material;
- use interactive elements of the electronic textbook to provide feedback to students;
- use flash materials on various devices and operating systems, which makes the learning process accessible to a larger number of students.

Thus, the use of Action Script and Macromedia Flash 8 technologies when creating the electronic textbook "Implementation of an integrated approach in teaching junior schoolchildren" contributes to better assimilation of educational materials related to integrated teaching of primary schoolchildren, making learning more interactive, accessible and effective.

The electronic textbook was prepared in accordance with the current educational program "Pedagogy and Methods of Primary Education" of the Pavlodar Pedagogical University named after A.Margulan, which corresponds to the calendar-thematic plan of the discipline "Features of the organization of integrated education in primary school."

This electronic textbook consists of two parts, the content of which is covered in extensive 8 topics. When studying the educational material of the topic, students are presented with practical tasks and literary sources. Each topic of the electronic textbook reflects aspects of integrated learning in primary school; in case of successful mastery of knowledge, skills and abilities for its implementation, positive results will be achieved in the formation of the process

of readiness of future teachers to carry out the pedagogical process of primary school on an integrative basis.

Thus, when considering the first topic, students study the State Educational Standard of Education of the Republic of Kazakhstan, Standard curricula and programs for general education subjects at the primary education level and other regulatory documents that ensure the implementation of an integrated approach in teaching primary schoolchildren. The result of studying this topic is knowledge about state documents on the basis of which integrated learning is carried out in the primary education system.

–As part of the study of the next topic, students consider concepts, characteristics of integration in learning; stages of development of integration in education. The basic principles in the theory of integration were the laws of dialectics about the relationship between parts and the whole, such an understanding of integrity, which is irreducible to a simple sum of parts and is understood as the interpenetration of parts of one whole. The results of studying this topic are:

–knowledge of integration processes in pedagogical theory and practice;

–knowledge about stages, classifications, types and forms, integrative concepts in education.

The third topic, "Specifics of implementing an integrated approach to teaching primary schoolchildren abroad," provides information about the Finnish school education system; The issue of integrated education in the Republic of Korea and Australia was considered. The results of studying this topic are:

- knowledge of regulatory documents governing integrated learning in primary education in Korea, Finland and Australia;
- knowledge about the features of the integrated approach in foreign countries;
- knowledge of the content, stages of integrated education for junior schoolchildren in Korea, Finland and Australia.
- When studying the next topic, "Tools for integrating educational areas in the content of primary education," students receive information about the mechanisms, methods, levels, functions, and principles of pedagogical integration in the education of primary schoolchildren. The results of studying this topic are:
- knowledge about the process of creating connections of a single whole, carried out by merging elements of several areas from other disciplines in one integrated educational subject; merging the foundations of science in revealing interdisciplinary educational problems of primary education;
- practical skills in different ways (subordination, gluing connections, blurring, concentration) to integrate scientific knowledge from different subject areas of primary education.
- In the topic being studied, "Practical tasks for creating an integrated lesson plan," students consider information about the necessary conditions for planning a short-term lesson plan; on pedagogical requirements for the development and implementation of an integrated lesson in primary school. The results of studying this topic are:
- knowledge about techniques, methods and technologies that are used in an integrated lesson;
- knowledge, skills and abilities to design an integrated lesson.
- When studying the following topic, "Layer-shaped form of organizing the content of an integrated lesson," future teachers consider the features of the structure, the analysis scheme of an integrated lesson, and analyze the layer-like form of organizing the content of the lesson.

The results of studying this topic are:

– knowledge of the features of the layer-like form of organizing the content of an integrated lesson in primary school;

– abilities and skills to determine integrated educational areas of academic subjects;

– the ability to determine forms, methods, and means of combining scientific knowledge in teaching primary schoolchildren, which contribute to the effective solution of the goals of an integrated lesson.

While studying the topic "Spiral form of organizing the content of an integrated lesson in Science in grade 1," future primary education teachers consider the features of the spiral form of organizing the content of an integrated lesson. The results of teaching the topic are:

–knowledge of the principle of concentricity, expressed in the gradual increase and complication of content, methods of learning for primary schoolchildren;

–skills and abilities to design a lesson based on the spiral form of organizing the content of primary education, taking into account the features and specifics of this form.

–The next topic of the electronic textbook, "An interpenetrating form of organizing the content of an integrated lesson," reveals the characteristics and features of the interpenetrating form of a lesson based on the integration and interdisciplinary knowledge in teaching primary schoolchildren. The main learning outcomes after studying this topic are:

–knowledge of the specifics of the interpenetrating form of an integrated lesson;

–the ability to switch the attention of primary schoolchildren from one type of activity to another (from plot-role-playing to didactic, then to construction-constructive, theatrical, etc.);

–skills and abilities to construct a lesson based on an interpenetrating form of organizing the content of primary education.

All topics of the electronic textbook are logically interconnected and contribute to broadening the horizons of students, enriching knowledge and developing professional skills.

– Practical assignments on the topics studied in the electronic textbook are designed to practice acquired knowledge and contribute to:

– deepening knowledge about the integration of educational areas in the content of primary education;

– formation of theoretical foundations for the implementation of an integrated approach in teaching children of primary school age;

– systematization of knowledge, skills and abilities of technological integration of educational material for primary school students;

– development of skills and abilities in developing an integrated lesson in primary school;

– expanding existing knowledge about the forms of organizing the content of an integrated lesson in primary school.

The content of the electronic textbook "Implementation of an integrated approach in teaching junior schoolchildren" is one of the tools for developing students' readiness for integrated training of junior schoolchildren, which contributes to a consistent and multifaceted disclosure of the studied processes of pedagogical integration.

The experimental testing of the electronic textbook consisted of three stages (ascertaining, formative, control). In the structure of future teachers' readiness for integrated learning in primary school, we have identified the following components: motivational-value, cognitive, activity. Next, we identified the characteristic features of high, medium, and low levels of formation of the desired readiness.

The high level of students' readiness to implement integrated learning in primary school is characterized by an active interest in their future profession and in the use of an electronic textbook; the presence of knowledge, skills and abilities to integrate scientific knowledge in teaching primary schoolchildren.

The average level of students' readiness to implement integrated learning in primary school is characterized by insignificant interest in their future profession and in using an electronic textbook; students have insufficient knowledge, and skills are superficial.

The low level of students' readiness to implement integrated learning in primary school is characterized by a lack of interest in their future profession and in the use of an electronic textbook; future teachers do not have the necessary knowledge, and the skills and abilities of integrating scientific knowledge are formed at an elementary level.

At the ascertaining stage of the experiment, we tested students in order to assess the initial state of readiness of future primary education teachers to implement integrated learning. The test tasks were compiled based on the research of (Sukharevskaya, 2013). Here are some answers to testing questions.

So, for example, to the question: "What is integrated learning in primary school?"

– 14.1% of the studied students responded that integrated learning consists of combining educational material, thematically repeated in different years of study at different levels of complexity;

– 78.2% of the students surveyed were unable to give a substantiated answer;

– 7.7% of respondents answered that integrated learning consists of combining similar material from different academic disciplines.

To the question: "What is the role of cross-cutting sections and topics in integrated learning?"

– 3.4% of students responded that cross-cutting sections and topics contribute to the implementation of interdisciplinary connections, with the help of which junior schoolchildren repeat and build up educational material throughout the entire period of study;

– 18.7% of respondents believe that cross-cutting sections and topics are the system-forming basis of the content of primary education;

– 77.9% of the students surveyed responded that they could not determine the role of cross-cutting sections and topics in integrated learning.

To the question: "Is the principle of spiraling important for integrated learning?" students formulated their answers as follows:

– 54.4% responded that this principle does not play a special role in integrated learning;

– 40.1% indicated that the principle of spiraling is key when designing an integrated lesson;

– 5.5% responded that the principle of spiraling is important for integrated learning, since the content of primary education is expanded and enriched with new components, with the deepening of existing knowledge.

To the next question "What are the features of integrated education for primary schoolchildren?":

– 7.7% of the surveyed students noted the importance of applying or using the principle of spiraling, pedagogical goal setting, cross-cutting topics and sections in the content of primary education;

– 53.7% of students responded with vague ideas about the features of learning based on the integration of scientific knowledge;

– for the remaining 38.6% of the students, only initial ideas about integrated education for primary schoolchildren were found in their answers.

To the question "How do you assess your level of preparedness for integrated learning in primary school?" we received the following responses:

– 67.3% of respondents noted that existing training at the university does not fully contribute to professional and pedagogical readiness in this direction, innovations are needed in the form of educational and digital training courses;

– 20.2% of students are satisfied with the level of preparation for integrated education in primary school;

- and only 12.5% of respondents have knowledge about the principles, patterns, and means of integrated education for primary schoolchildren, but believe that they are not sufficiently prepared for the practical implementation of this type of education.

The test results showed changes in the experimental and control groups, which are presented in Table 1.

**Table 1**

*Levels of readiness of future teachers for integrated teaching of junior schoolchildren before the introduction of an electronic textbook (in%)*

| Readiness levels | Experimental group (EG) | Control group (CG) |
|---|---|---|
| Low | 50,7 | 56,1 |
| Medium | 39,9 | 34,9 |
| High | 9,4 | 9,0 |

Analysis of the results of Table 1 indicates that in the control and experimental groups students with a low level of readiness for integrated learning predominate (50.7% in the EG and 56.1% in the CG). This is due to the insufficient development of knowledge about integrated learning, which directly affected the development of skills and abilities to apply them in the educational process of primary school during the period of industrial and teaching practice.

To increase the levels of formation of the required readiness, at the stage of the formative experiment we tested the electronic textbook “Implementation of an integrated approach in teaching primary schoolchildren,” the content of which included topics and tasks that contributed to increasing the levels of the studied readiness of future primary education teachers.

At the stage of the control experiment, we conducted a final test of students using the online service for organizing test tasks - “socrative.com”, identified the levels of learning outcome, and also determined the effectiveness of the developed electronic textbook. The results are presented in Table 2.

**Table 2**

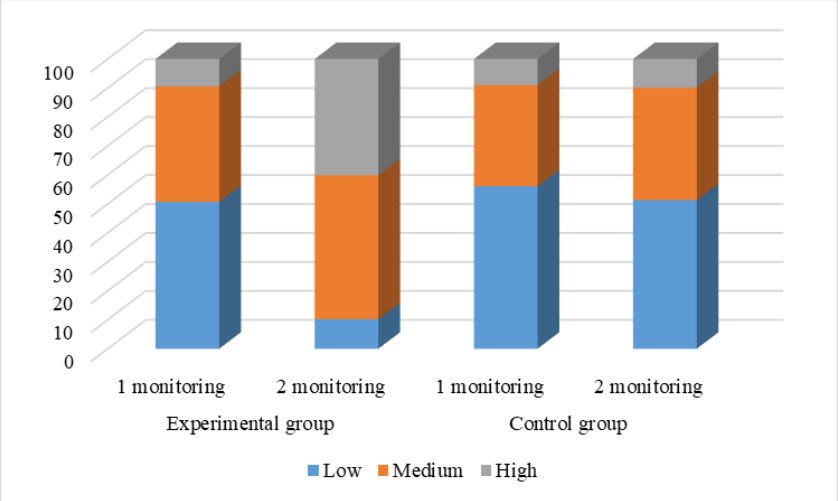
*Results of the readiness of future teachers for integrated teaching of junior schoolchildren after testing the electronic textbook (in%)*

| Readiness levels | Experimental group | | Control group | |
|---|---|---|---|---|
| | 1 monitoring | 2 monitoring | 1 monitoring | 2 monitoring |
| Low | 50,7 | 10,2 | 56,1 | 51,3 |
| Medium | 39,9 | 49,7 | 34,9 | 38,8 |
| High | 9,4 | 40,1 | 9,0 | 9,9 |

The results of statistical processing of data from the control stage of the study showed a positive trend in the levels of readiness of students in the experimental group from 9.4% to 40.1%, and in the control group there was no positive increase in students’ readiness levels, since the electronic textbook was not tested in this group (Fig. 1).

**Figure 1**

*Results of the readiness of future teachers for integrated teaching of junior schoolchildren (after testing the electronic textbook)*



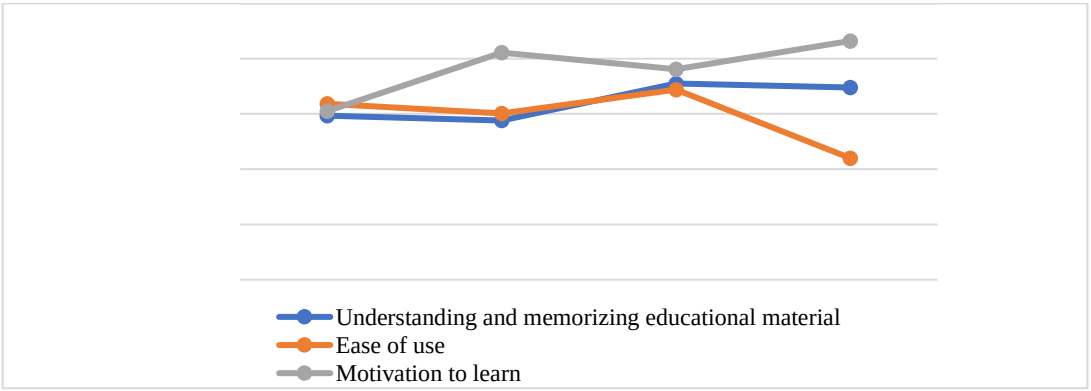

The implementation of the fourth objective of the study involved a comparative analysis of the perception of educational information on integrated education for primary schoolchildren from traditional and electronic textbooks. To do this, we used a traditional printed textbook (Kalimova, 2024) and the developed electronic textbook. Students were encouraged to explore topics from the learning resources provided. We have defined the following criteria for information perception:

- understanding and remembering educational material;
- ease of use;
- motivation to learn.

After studying the educational material from the proposed resources, students passed a survey. Analysis of the survey results allows us to assert that students of the educational program "Pedagogy and methods of primary education" better perceive and remember educational information posted in the electronic textbook. The results of a comparative analysis of the perception of educational information on integrated education for junior schoolchildren from traditional and electronic textbooks are presented in Figure 2.

**Figure 2**

*Results of a comparative analysis of the perception of educational information on integrated education for primary schoolchildren from traditional and electronic textbooks*



The diagram shows that 35.5% of students better understand and remember educational material from an electronic textbook, while the perception and understanding of similar material from a traditional textbook among these students was 29.7%. This confirms our assertion that electronic textbooks are more effectively used for understanding and memorizing in the practice of implementing an integrated approach to teaching primary schoolchildren and using the technology of pedagogical integration of scientific knowledge. The multimedia content of the electronic textbook allows to show to students in a flexible manner the connection between knowledge from individual fields of science and the need to study it at the intersection of traditional primary school subjects.

Analysis of the results for the second criterion shows that ease of use is one of the key advantages of electronic textbooks. The average percentage of the "ease of use" criterion of an electronic textbook in the experimental group (EG) is 34.4%, which is higher compared to a traditional textbook in the EG, where this figure is 31.8%, indicating a clear advantage of an electronic textbook that includes interactive elements, such as animations, audio, video and tests that promote ease of use.

The results of the data for the third criterion showed that motivation to learn plays an important role in the effectiveness of educational materials, so 38.5% of students noted that the electronic textbook contributes to a higher level of motivation to learn. This is due to the variety of interactive features that the electronic textbook contains, such as interactive tasks and the ability to receive instant feedback. The remaining 30.1% of students believe that a traditional textbook has an advantage over an electronic one, due to the provision of a physical sensation of the book and safety for vision.

Thus, the results of the comparative analysis indicate that, in general, electronic textbooks can significantly improve students' perception of information compared to traditional textbooks. However, traditional textbooks still have value and may be preferable in certain circumstances. It is important to find a balance between the use of electronic and traditional textbooks to provide a learning environment for each student, taking into account their individual needs and preferences. This may involve combining both types of learning resources to create a comprehensive and flexible learning environment.

To check the statistical data of the experimental groups, we used the Pearson test ($x^2$), which allowed us to assess the significance of the differences between the actual and identified characteristics of the samples. For this purpose, the null and alternative hypotheses were formulated.

According to the null hypothesis ($H_0$), the distribution of levels of readiness of future teachers for integrated learning in primary school in the control and experimental groups *does not differ* at the control stage of the experiment.

The alternative hypothesis ($H_1$) assumes *the presence of positive changes* in the levels of readiness of future teachers for integrated learning in primary school in the control and experimental groups, at the final stage of experimental teaching work.

As a result of pairwise comparison, the alternative hypothesis was confirmed – $x^2_{emp.} > x^2_{cr.}$ (p 0.05) (Table 3).

**Table 3**

*Changes in the levels of readiness of future teachers for integrated education of junior schoolchildren (%)*

| **Sample** | **Levels** | | | $x^2_{emp.}$ | $x^2_{cr.}$ |
|---|---|---|---|---|---|
| | **low** | **medium** | **high** | | |
| CG | 51,3 | 38,8 | 9,9 | 60,8 | 5,74 |
| EG | 10,2 | 49,7 | 40,1 | | |

A comparative analysis of the research results showed that at the control stage of the experiment, the levels of readiness differed significantly in the EG and CG, which proved the effectiveness of the influence of the electronic textbook we developed on the formation of the readiness of future teachers for integrated learning in primary school.

Further in the study, we applied the method of expert assessments, which consists in attracting competent people, which allows us to objectively assess the effectiveness of the electronic textbook we developed. The purpose of the examination is to determine the effectiveness of the influence of the electronic textbook on the formation of the readiness of future teachers for integrated learning in primary school. The peer review process involved 3 independent experts in their professional activities. The collection of expert opinions was carried out through a questionnaire survey. The criteria for determining the effectiveness of the electronic textbook "Implementation of an integrated approach in teaching primary schoolchildren" were the following:

– expansion of professional interests and motivation among students of the educational program "Pedagogy and Methods of Primary Education" to implement integrated learning;

– orientation of future primary education teachers towards the long-term perspective of their activities;

– increasing the level of readiness of future primary school teachers for integrated learning.

By comparing the responses of the experts to the questionnaire, we came to the conclusion that developing the readiness of future teachers for integrated teaching of junior schoolchildren is a labor-intensive process that requires systematic work throughout the entire period of study in a higher education organization. The use of the electronic textbook "Implementation of an integrated approach in teaching primary schoolchildren" contributed to the generalization of students' theoretical knowledge about the features of pedagogical integration, the essence of integrated learning, algorithms and mechanisms of pedagogical integration, methods of combining the content of educational areas of primary education, the use of layer-like, spiral, interpenetrating forms in the development integrated lessons and more. The use of practice-oriented tasks included in the content of the electronic textbook has significantly expanded the scope of their use in the process of developing integrated lessons and exercises.

In general, the results of the experimental work convincingly indicate positive changes in the indicators of the formation of future teachers' readiness for integrated teaching of primary schoolchildren. Analysis of the research results shows that the number of students in the experimental and control groups who were at a low level of readiness decreased by 41.4% and 29.9%, respectively. Consequently, the positive dynamics of the results of shaping the readiness of future teachers for integrated teaching of primary schoolchildren confirms the effectiveness of the developed electronic textbook.

**Conclusion**

Electronic textbooks are being widely introduced into the practice of higher education

teachers, especially after the active use of distance technologies during the pandemic. Our research confirms that the use of the electronic textbook we developed contributes to the effective formation of the required readiness of students, and the significance is determined by its effectiveness and is expressed in the completeness, systematic assimilation of theoretical knowledge and the development of pedagogical skills in combining scientific knowledge.

It should be noted that the electronic textbook is not a replacement for a qualified teacher. Despite all its advantages, it cannot replace personal contact, and its "intellectual" capabilities are incomparable with human ones. At the same time, the content of the electronic textbook "Implementation of an integrated approach in teaching primary schoolchildren" ensures the effective formation of the required readiness and can be used as one of the elements of the practical component of the process of preparing primary education teachers for integrated education.

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