



Computer Technologies in the Realization of Bilingual Training in the National School (On the Example of Schools of the Republic of Bashkortostan of the Russian Federation)

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Abstract: *In modern conditions of development of national schools in multilingual regions of the Russian Federation, in particular in the Republic of Bashkortostan, the problem of designing a bilingual (Russian-national or national-Russian) methodology is important, but at the same time not sufficiently developed for the federal component disciplines. The article reveals an attempt to solve to a certain extent this problem through the use of electronic educational materials in teaching mathematics. Depending on the target component, two types of bilingual methods are distinguished: one of them – with the predominance of the national-Russian bilingualism, the other - with the predominance of the Russian-national. Electronic textbooks provide an opportunity to combine the possibilities of both techniques. The article describes the electronic learning materials developed by the author that allow realizing bilingual education in the Russian national (non-Russian) school. Efficiency was identified on the basis of a pedagogical experiment, the criterion of effectiveness – the quality of students' cognitive activity; the reliability of the changes obtained was substantiated by statistical methods using Student's t-test (by William Gosset's).*

Keywords: *e-learning materials, national school, bilingual technique.*

INTRODUCTION

The exponential growth of information technology is increasingly affecting all spheres of public life, including the education system. It can be safely asserted that the modernization of the education system is inherently linked with the introduction of innovative computer technologies into the educational environment.

In our study, computer technologies are used to solve the problem of implementing bilingual instruction in mathematical disciplines in national schools on the territory of the Republic of Bashkortostan of the Russian Federation.

Russia is like as a multinational state has a number of regions with two (and more) state languages.

In the Republic of Bashkortostan, on the basis of the Law on Languages [1], two state languages operate: Russian and Bashkir. Therefore, education in general schools can be conducted both in Russian and in Bashkir. In addition, other nations can use their native language in teaching. For example currently in the Republic of Bashkortostan, instruction is conducted in six languages: Russian, Bashkir, Tatar, Chuvash, Mari and Udmurt. In addition, as confirms our ascertaining study, in various rural areas there are a lot of national schools where teaching all disciplines of the federal component, including mathematics, up to 9th grade, and sometimes up to 11th grade, is conducted on the second state language of the republic – in the Bashkir language.

1. Implementation of the bilingual technique through computer technology

Using the term “bilingual” the author has in mind the use in teaching of two languages: Russian and non-Russian (national, which is the pupil's native language). The problem of using the Russian language in teaching and, accordingly, bilingualism, is not facing teachers and students of urban schools in our republic. It occurs in mono-speaking villages, where the population uses their native language in communication and work.

Depending on the target component, the author singled out two types of bilingual methods: one of them – with the predominance of the national-Russian bilingualism, the other – with the predominance of the Russian-national. National-Russian bilingualism is used if the school has the goal of developing the native language as a language that will be used in scientific and working life, not limited to everyday life. Education in this case is fully conducted in their native language, and the Russian language is used so that students are not limited to their native language, but can also use Russian-language educational and scientific literature.

Russian-national bilingualism does not aim at the development of a native national language. With this type of bilingualism, learning is done in Russian using ordinary Russian-language textbooks. The native language is used only to facilitate the perception of information, for the implementation of full cognitive activity, which is based on human speech.

Without the use of special educational literature and bilingual techniques, without appropriate teacher training, one should not expect a high level of cognitive activity of students in the process of teaching the disciplines of the federal component, in particular, to mathematics. This thesis is confirmed by the analysis of school practice and pedagogical literature.

The study of the history of the functioning of national schools in the republic shows the absence in them of a pedagogically grounded bilingual teaching methodology. However, we proceed from a different attitude to the need for such training.

We proceed from a positive theoretical base – the results of the studies of E. Peel and W. Lambert [10], E. Bialystok and K. Hakuta [9], L. Salekhova [5], who proved that bilingual education contributes to the preservation and further improvement of human cognitive abilities. The basis of the methodology developed by us, covering both types of bilingual education (national-Russian and Russian-national), is the parallel use of two languages. If you are creating relevant bilingual textbooks in paper form, then this will require a large amount of text. School textbooks will be voluminous and heavy, but this is unacceptable. This problem is solved by the use of appropriate electronic versions of educational materials.

1.1. Electronic textbooks for the implementation of bilingual techniques

As part of the experimental work on the introduction of bilingual education with the help of computer technology, we created a number of educational materials on mathematics based on the Help & Manual program [3, 4].

Using Help & Manual in the textbook, you can put a large amount of information and tasks for students in several languages. In doing so, we use various text layout options: 1) the information can be displayed on the screen simultaneously in two (sometimes in three) languages; 2) the text in the second (or third language) language appears, if necessary, only when you click on a specific label. For example, in Figure 1 there is a screenshot of a fragment of the textbook, containing information simultaneously in two languages: Russian and Bashkir.

Текст задачи на русском языке	Текст задачи на башкирском языке
1.4.	
Раньше на территории Стерлитамака находилась почтовая станция «Ашкарский Ям», но купец Савва Тетюшин решил получить выгоду из соляной реки Стерля и построил здесь соляную пристань. Таким образом, год постройки соляной пристани является официально годом рождения города Стерлитамака. Кстати, Стерлитамак – это башкирское название, расшифрованное как горло Стерли. Давайте узнаем, в каком году был основан город: если от искомого числа вычесть 1503, полученную разность умножить на 7 и от полученного произведения вычесть 75, то результат равен году рождения города на Стерле.	Элек Стерлөтөмак тер-риторияһында «Ашкарзәр Ямы» тигән почта станцияһы булған, ләкин саузағәр Савва Тетюшин бында Эстәрле исемле тоҙло йылғанан табыш алып өсөн тоҙ пристәне төзөгән. Шулай итеп, официаль рәуештә Стерлөтөмак калаһының барлыкка килгән йылы булып тоҙ пристәне төзөгән йыл булып тора. Өйткәндәй, Стерлөтөмак – ул башҡорт атамаһы, Эстәрленең тамағы мәғәнәһен аңлата. Өйзөгөз карап утәйек, калаға ниндәй йылда нигеҙ һалынған: әгәр эзләнгән һандан 1503 алып, барлыкка килгән айырманы етегә кабатлап, килеп сығккан кабатландыҡтан 75 алһан, һөҙөмтә каланың барлыкка килгән йылына тигеҙ була.

Figure 1. Screenshot of the fragment of the textbook where presents the tasks in two languages simultaneously: in Russian (left) and in Bashkir (right)

In Figure 2 there is a screenshot of the textbook fragment containing the text of the task in Russian, but there are also tags with the indication of other languages: Bashkir, Tatar, English. By clicking on one of these labels (it is possible and at all at the same time), the user can see the texts in other languages.

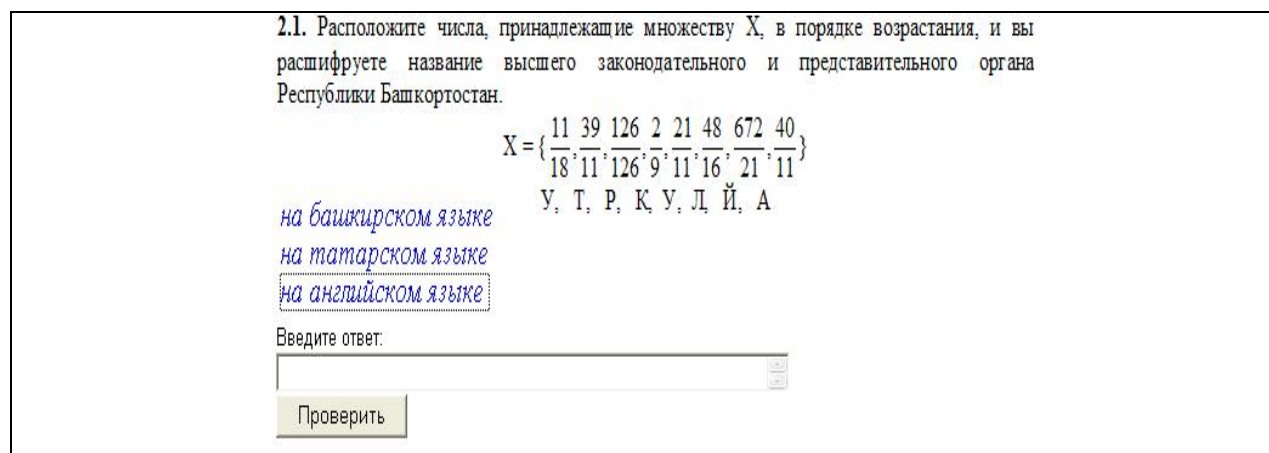


Figure 2. Fragment of the electronic textbook in a state where the texts in Bashkir, Tatar and English are hidden

In Figure 3, we see the same page of the tutorial when you click on the label.

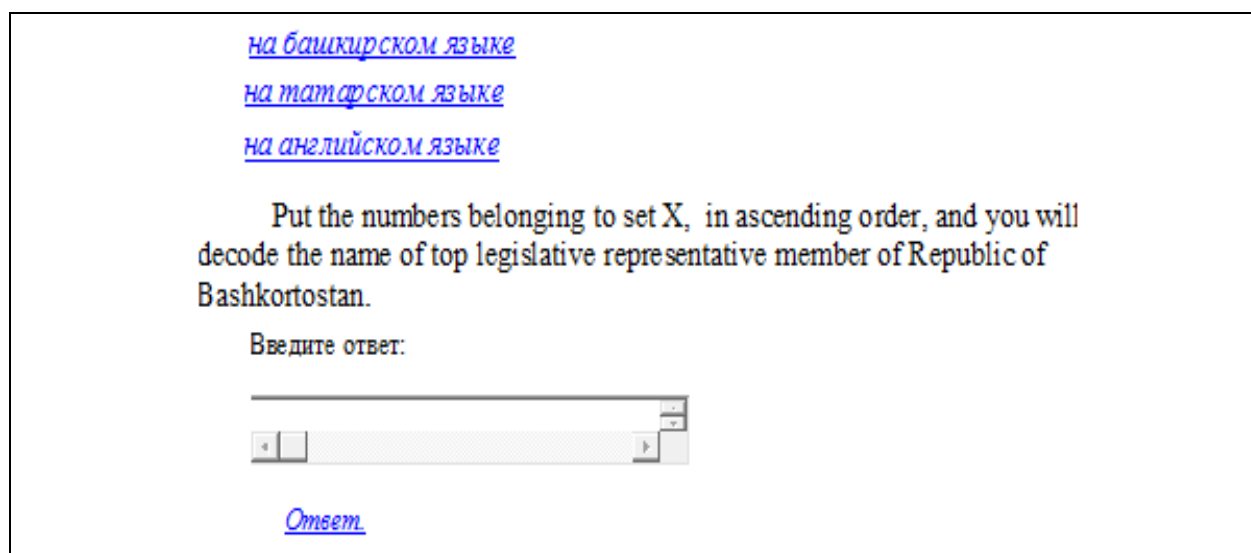


Figure 3. A fragment of the same page of the electronic textbook when you hover over the words “English”

1.2. Electronic lessons for the implementation of the bilingual technique

Another direction in the use of computer technology in our studies is the modeling of electronic lessons on the basis of the author’s platform “Electronic Game School”. Our creative team is developing a project “Development and implementation of the model of the gaming educational platform “Electronic Game School” (Project 06-5 dated December 15, 2016, supervisor – R.Kh. Karimov). This project is aimed at solving the tasks formulated in the republican document “The Concept of the Development of Electronic Education in the Republic of Bashkortostan for the period 2015-2020” [2] and is implemented in the grant support of the Ministry of Education of the Republic of Bashkortostan.

This article does not aim at a complete description of the developed platform, intended for electronic game training of schoolchildren of the Republic of Bashkortostan.

Let’s give only some brief explanations on the developed platform. The platform is built on a client-server architecture. To use the Platform, a modern user agent (browser-client) is required, in which support

for the multi-paradigm JavaScript scripting language that implements the ECMAScript 5.1 [6] standard is to be enabled. The server is a virtual dedicated server on which the Linux distribution is installed. The server uses the PHP scripting language and the Node.js. software platform. As web servers, Apache is used with PHP as a module for quick execution of scripts, as well as Nginx as a reverse-proxy server. The data is stored in the Database Management Systems (DBMS) MariaDB [12]. Further we shall limit ourselves to describing only those aspects that allow us to use this Platform in order to implement the bilingual teaching methodology.

In the platform developed by us, as well as in the textbook described above, it is possible to make hyperlinks and tabs for translating texts into another language. If the main text is in Russian, then the lesson model allows the student to see the translation of the full text or the term into a national (non-Russian) language. If the lesson is organized in a national (non-Russian) language, then by pressing special highlighted tags, the student can receive translation of the information into Russian.

Figure 4 shows an example of a screenshot of the electronic math lesson for grade 9 in the Bashkir language. On the screen you can see the highlighted label containing the term in the Bashkir language: “**әсбыуындын тамырзаны**”.

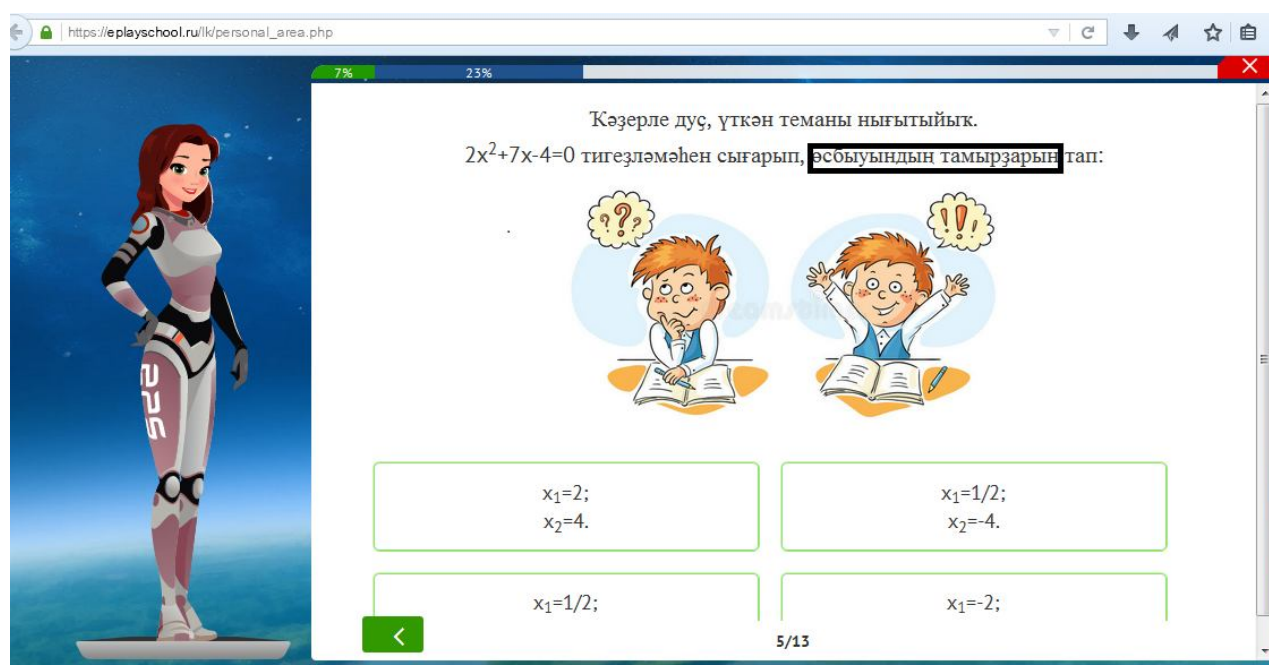


Figure 4. Fragment of the screenshot of the electronic lesson in the Bashkir language

When you click on the highlighted label, the term in Russian appears on the screen of the electronic lesson. And the game character – the girl “ELIS” (from the abbreviation “Electronic Intellectual System”), accompanies the students during the lesson and voices the terms.

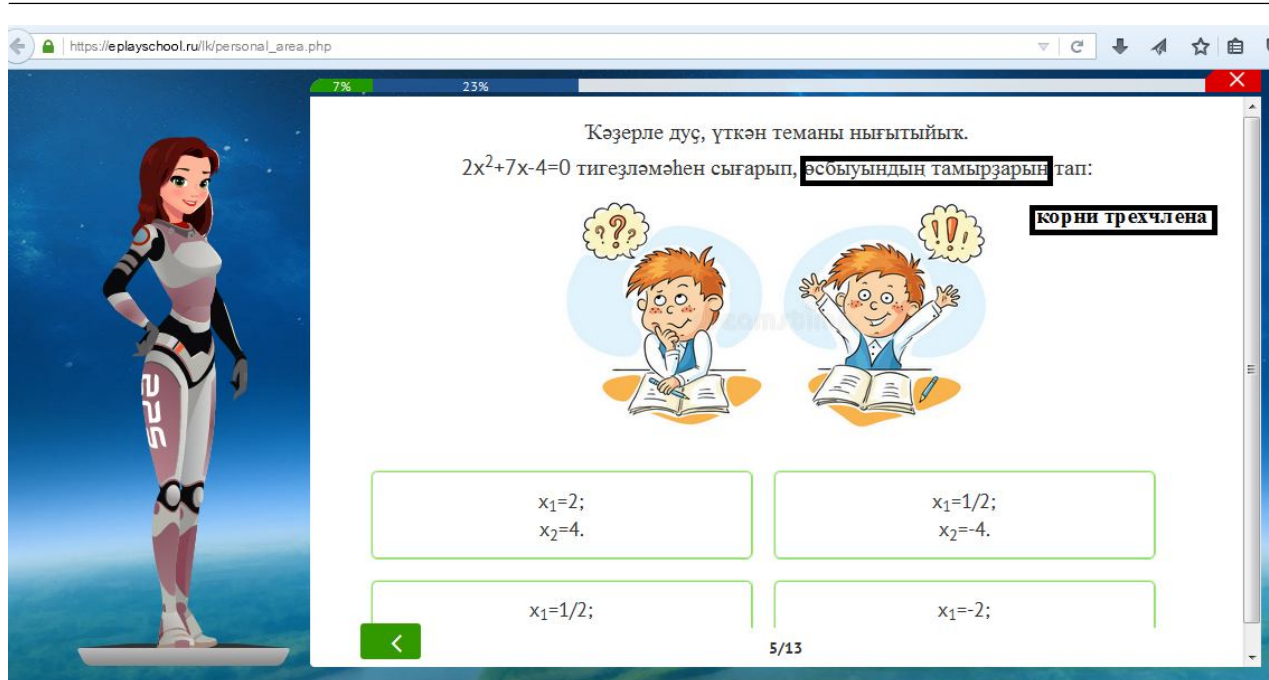


Figure 5. Screenshot of the fragment of the lesson, where the student can see the translation of the selected term

2. Process and results of a pedagogical experiment

As is known, the overall efficiency of using electronic educational materials depends on the fulfillment of certain requirements for such materials and is verified using a number of quality indicators: program-technical, pedagogical, psychological, aesthetic, ergonomic and other indicators. Such verification was carried out according to the activity plan of the scientific and educational laboratory of methodical research of the Sterlitamak branch of the Bashkir State University and in accordance with the methodology developed by a group of Uzbek scientists under the guidance of M.N. Choi [8, 128–146].

But since in this article we are talking about electronic materials as a means of implementing bilingual methods aimed at improving the quality of cognitive activity of students in the context of language problems, the degree of development of cognitive activity of students in national schools will serve as an indicator of the effectiveness of these materials. In the Republic of Bashkortostan, in recent years, there has been a tendency to reduce national schools, where instruction fully takes place in the native (non-Russian) language in all disciplines until the end of schooling. Therefore, the experiment covered only such national schools in which instruction in the Bashkir language takes place no more than in elementary school (grades 1–4), and in secondary school, starting from grade 5, instruction is translated into Russian in all academic subjects. Thus, homogeneous groups of students of national schools were composed: the experimental group consisted of 62 schoolchildren and the control group – 60 schoolchildren. The experiment took place over 2 semesters.

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Diagnostics of students' cognitive activity was tested using a complex method developed by Professor P.A. Sorokun [7, 96–100], modified with respect to mathematics. This method is based on the "speech character of information perceived and acquired by students in the learning process".

In the learning process, students of experimental groups, using electronic materials, had the opportunity at any time to receive a translation of the text into their native language to fully understand the information. This allowed them to compare terms, to highlight the consciously essential properties of concepts in both languages. Students of the control group, studying according to traditional Russian-language textbooks, did not have such an opportunity.

To obtain quantitative and qualitative characteristics of cognitive processes, we fixed a certain amount of speech information corresponding to the age possibilities of students and in which there is a “description of objects and phenomena, connections and relationships between them, as well as actions performed by them or with them”, and there is also a need solve a math problem. In our experiment, one of the diagnostic texts was mathematical problems with an additional plot. One of them, for example, is presented above in Figure 1 in russian.

The text is read to the students, after which tasks are given to test the three components of cognitive activity: reproduction of information, comprehension of information, modeling information.

To identify the quality of information reproduction (in the diagrams of figures 6 and 7 marked as I) it is proposed:

- 1) set out the text in writing;
- 2) depict objects, phenomena and actions described in the text through the drawings.

To identify the quality of understanding the information (in the diagrams marked as II):

- 1) to identify the main words and their meaning; highlight words with insignificant semantic content;
- 2) select and depict the basic relationships, highlight non-essential relationships.

To check the quality of modeling information (in the diagrams designated as III):

- 1) draw up a diagram reflecting mathematical relationships;
- 2) to make a mathematical model in the form of an expression, equation, inequality.

For each criterion, points were set from “0” to “2”: “0” – a low level of task performance, “1” – an average level of task performance, “2” – a task was completed completely and correctly. Thus, students by each criterion can get from zero to 4 points.

Figures 6 and 7 show diagrams showing the results of the initial and final sections (after two semesters) for each criterion in the experimental and control groups.

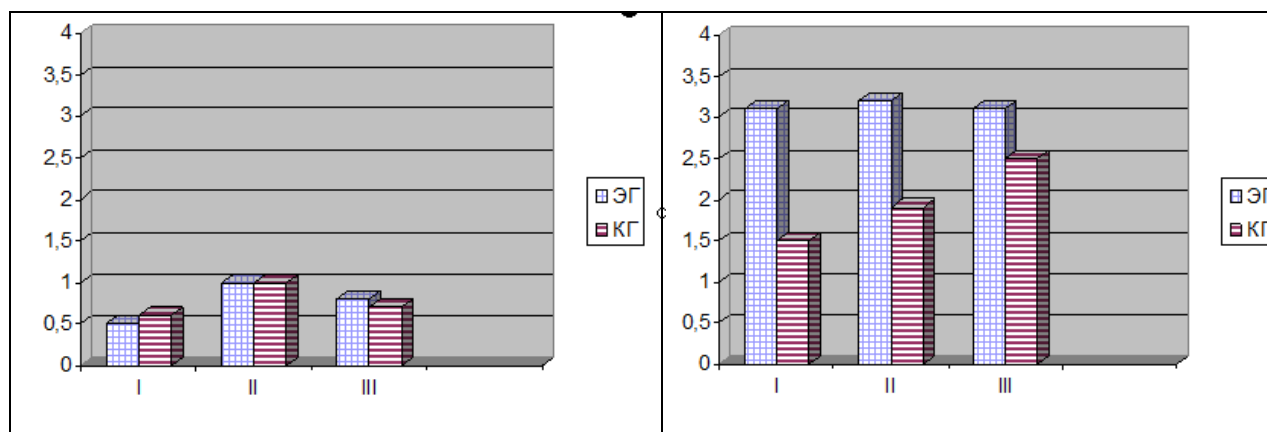


Figure 6. Numerical indicators of the quality of the cognitive activity of the experimental and control groups before the experiment

Figure 7. Numerical indicators of the quality of cognitive activity of the experimental and control groups after the experiment

The total quantitative characteristic of the cognitive processes of each student individually and the group as a whole was also calculated. In total, each student could get a maximum of 12 points. The average maximum value of the indicator of the level of cognitive processes for each group is also equal to 12. The average total characteristic of the cognitive processes for the experimental and control groups is given in table 1.

Table 1.

The average total characteristic of cognitive processes for the experimental and control groups

Experimental group		Control group	
Before the beginning experiment \bar{X}_1	After the end of the experiment \bar{X}_2	Before the beginning experiment \bar{Y}_1	After the end of the experiment \bar{Y}_2
2,3 (19 %)	9,4 (78 %)	2,3 (19 %)	5,9 (49 %)

To check the accuracy of coincidences and differences in the mean values in the two samples, we used

the Student's t-test [11, 118-121], which is calculated by the formulas: $t_1 = \frac{(\bar{X} - \bar{Y})}{\sqrt{m_1^2 + m_2^2}}$;

$$m_1 = \frac{S_1}{\sqrt{N_1}}; m_2 = \frac{S_2}{\sqrt{N_2}}.$$

In these formulas, $N_1 = 62$, $N_2 = 60$, and S_1 and S_2 are the mean square deviations of the experimental and control groups. The value of t was calculated before the experiment to prove the homogeneity of the experimental and control groups, and then after the experiment, to prove that these groups were no longer homogeneous

According to the table "Student's test. Bounds for t with f degrees of freedom" [11, 347], for the level of significance $\alpha = 0.05$ (5%) and the number of degrees of freedom $f = 60 + 62 - 2 = 120$, we get the following values: $t_{0.05; 100} = 1.972$, $t_{0.05; 200} = 1.984$.

So, before the experiment, the obtained value is $t = 0.5$, that is, $t < t_{0.05; 120}$; $t < 1.972$.

This means that the experimental and control groups were homogeneous according to the measured property.

After the experiment, it turned out that $t = 3.54$, that is, $t > t_{0.05; 120}$; $t > 1.984$. Thus, it is statically proven that the differences between the experimental and control groups in the quality of the formation of cognitive activity are statistically significant.

According to the methodology for assessing the effectiveness of educational materials [8, 128-146], an important element of the study is the study of the attitude of users to these materials. For this purpose, after the experimental training, a survey of pupils and their teachers was conducted. The questionnaire consisted of closed and open questions. Respondents answered closed-ended questions using the short answers provided in the questionnaire itself. Open-ended questions required a detailed response, explanations, and substantiations written by the respondents themselves.

Among the questions of the questionnaire for pupils were the following:

- Do you like the used e-books and e-lessons?
- Would you like to constantly use such aids in the lessons on other subjects?
- Does the availability of a Bashkir translation help better understand the information?
- Math lessons become more interesting with the use of such manuals?
- What specifically liked the electronic textbooks?
- What did not like in electronic textbooks?
- Want to learn how to enter your information into the Platform?
- Do you like some information translated into English?
- Write down what difficulties do you see with the constant use of electronic manuals and electronic lessons?

More than 90% of pupils answers to all questions of the questionnaire were of a positive nature, negative answers were associated only with the fact that not all respondents had computers and the Internet for personal use.

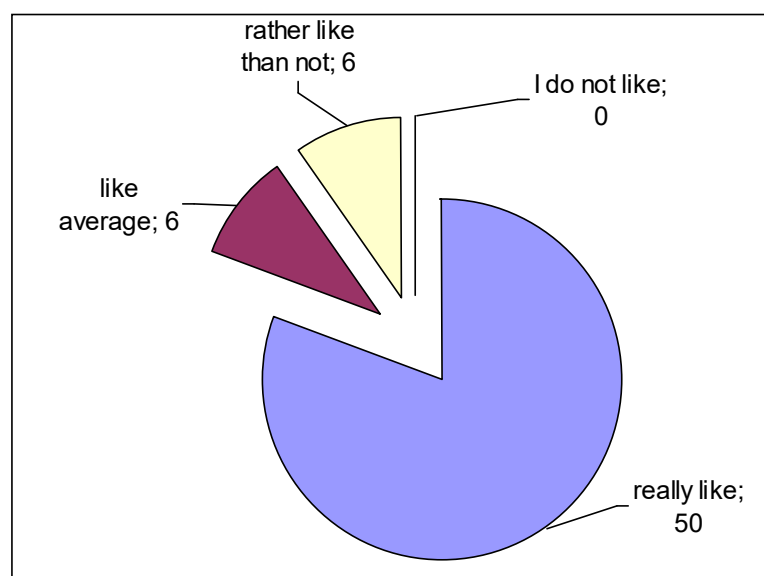


Figure 8. The attitude of the 62 pupils of experimental group to electronic textbooks and electronic lessons

We realized that a positive attitude to the developed teaching aids is not only related to the quality of such manuals. We take into account that the age group of pupils of the 5th is characterized in general by a positive attitude to everything new, especially to modern electronic gadgets. In this regard, we were interested to know the opinion of teachers. 155 mathematics teachers received special training during advanced training courses on the use of developed electronic materials. Of these, 5 teachers of national schools participated further in a formative experiment in the process of teaching mathematics to 5th grade students using the developed materials. At the same courses, teachers were trained in the design of electronic lessons in the “Electronic Game School” platform.

After the training, all teachers were surveyed. The results of this survey are presented in table 2. The results of the survey of teachers are presented in table 2.

Table 2.

The results of the survey of teachers to identify attitudes towards the use of electronic educational materials

№ п/п	Questions to teachers	Teachers trained but not participating in the experiment		Teachers - participants in the formative experiment	
		Number of answers	In percents	Number of answers	In percents
1.	Is it necessary to use electronic textbooks and electronic lessons in the process of teaching schoolchildren to math?				
	A) Yes	135	90	5	100
	B) No	10	6,7	0	0
	C) Difficult to answer	5	3,3	0	0

1.	Is it necessary to use electronic learning materials in the educational process of the national school for bilingual education in mathematics?				
	A) Yes	135	90	5	100
	B) No	5	3,3	0	0
	C) Difficult to answer	10	6,7	0	0
2.	Are the submitted electronic materials an element of the bilingual technique?				
	A) Yes	135	90	5	100
	B) No	0	0	0	0
	C) Difficult to answer	15	10	0	0
3.	Do you have experience using electronic materials in the educational process?				
	A) Yes	140	93,3	5	100
	B) No	10	6,7	0	0
4.	What is the positive role of the developed electronic materials in the educational process?				
5.	Do these materials match the math curriculum?				
	A) Yes, fully	135	90	5	100
	B) No, do not match (why?)	0	0	0	0
	C) Difficult to answer	15	10	0	0
6.	Did you have experience in implementing bilingualism through the use of e-learning materials (before training)				
	A) Yes	6	4	5	100
	B) No	1445	96	0	0
7.	Is it necessary to use Russian-Bashkir bilingual technique in teaching math in the 5th grade?				
	A) Yes (why?)	135	90	5	100
	B) No (why?)	15	10	0	0

When answering the 4th question of the open type questionnaire, the teachers highly appreciated the role of electronic materials. Among the answers were: "helps to better understand the material, the text of the task", "forms mathematical speech", "accelerates the understanding of mathematical texts", "increases the cognitive abilities of students", "increases students' interest in mathematics", "improves communication skills of students" and etc.

However, we must also state that so far there is a group of teachers (in our case it is 9,7 %) who actively deny the role and necessity of e-learning materials in general.

Analysis of negative answers to the 7th question allowed us to divide the respondents into two groups. One group (8 people, which is 53,3% of the number of negative answers, and 5,2% of the total number of teachers who attended the training), justified their negative attitude by the fact that mathematics has a universal language. Therefore, these respondents believe that it is enough to teach students from the very beginning only in Russian. In their opinion, there is no difference in which language to teach, so no special bilingual methodology is required.

The second group of respondents (7 people, which is 46,7% of the number of negative answers, and 4,5% of the total number of teachers who attended the training) named other reasons.

Negative attitude to the creation of methods based on Russian-Bashkir bilingualism, justified by the fact that children of Bashkir nationality should be taught from 1st to 11th grades in their native language, so there will be no need to develop this type of bilingual methodology.

However, analysis of the results of the survey shows that the majority of teachers note the positive role of e-learning materials: textbooks and e-lessons in the system of teaching schoolchildren, including schoolchildren of national schools.

CONCLUSIONS AND FUTURE WORK

1. The conducted formative experiment with pupils of the 5th grades of national schools, in the course of which the author's developed electronic textbooks were used, which gave positive results, allows us to continue the introduction of these materials into the educational process of national schools, as well as to develop such materials on other sections of mathematics and other academic subjects of the federal component.

2. Electronic lessons in the "Electronic Game School" platform are being successfully implemented in the educational process in 26 pilot schools of the Republic of Bashkortostan, while teachers from all schools are involved in constructing new lessons to place them in this platform.

3. At the advanced training courses for teachers of our republic, trainings are actively conducted on the use of developed electronic mathematics. The analysis of the questionnaires of teachers who have undergone trainings (more than 150 teachers of mathematics) regarding the feasibility of using the developed manuals for bilingual education allows us to predict that the use of electronic materials will actively enter the practice of schools in the Republic of Bashkortostan

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