

# Perception of Electronic and Printed Text by Younger Students with Intellectual Disabilities and Normative Development

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## ABSTRACT

Information and communication technologies can be used at any stage of joint organized activity with students with mental retardation (intellectual disabilities). The contradiction between objective necessity and the real level of implementation of information and communication technologies in the educational process is revealed. The article presents the results of an experimental study of the perception of text in electronic and printed form by younger students with mental retardation (intellectual disabilities) and normative development. Features of the application of information and communication technologies in work with students with mental retardation (intellectual disabilities) are revealed.

**Keywords:** *information and communication technologies, elementary school students with mental retardation (intellectual disabilities), normative development, visual perception*

## 1. INTRODUCTION

Currently, the process of digitalization of education is ongoing in our country, including through the active introduction of information and communication technologies, which are becoming a prerequisite for successful learning and social adaptation of children [1, 2, 4, 7, 8].

Information and communication technology (ICT) is a generalized concept that describes the methods, ways and algorithms for collecting, storing, processing, presenting and transmitting information.

Informatization of education is a process aimed at providing the education sector with the methodology and practice of developing and optimal use of modern ICT tools focused on the implementation of the psychological and pedagogical goals of training and education [9].

Undoubtedly, the use of ICTs opens up new prospects and amazing learning opportunities, including the ability to increase the effectiveness of corrective-developing work with children with health disabilities (CHD) [2, 3, 7, 8, 10].

Teachers emphasize the need to individualize instruction and note difficulties in providing an individual approach, while the use of digital technologies allows students to offer assignments based on their capabilities, speed of perception of information and other mental, personal characteristics. In conditions of inclusive education, it is digital technologies that can help in solving the issues of adaptation and individualization, provide the necessary support for students with different capabilities (N.P.

Astrametskaya, N.I. Pak, L. B. Khagai). N.P. Astrametskaya E.N. Soroko, E.S. Chuprova note the following advantages of ICT over traditional teaching aids:

First, ICTs make it possible to quickly find and transmit the necessary information, since the success of the educational process largely depends on the selection of exactly that reliable and interesting information in the huge information stream, which can serve as the basis for the formation of new knowledge, systematization of previous ideas, achievements or deepening understanding of the material.

Secondly, movements, sound, animation, used, for example, in multimedia presentations, attract children's attention for a long time and contribute to increasing interest in the material being studied. This allows us to solve the problem of enhancing the cognitive activity of children, the development of independence and activity of each child in learning, which contributes to a better development of educational material.

Thirdly, using video clips, slideshows, you can demonstrate such phenomena of the world and situations that are difficult to observe in real life, for example, the growth of flowers, the rotation of the Earth around the Sun, the transformation of a butterfly, the work of a factory, the change of day and night, the structure of the human body etc.

Fourth, ICTs can enhance cognitive interest, encourage children to search research activities, and contribute to the development of creative potential.

Fifthly, the alternation of types of tasks and exercises with different visual loads contributes to the increase in the working capacity of children in the lesson and the productivity of their activities.

The use of ICT helps the teacher to make the lesson not only more attractive, but also developing, which is especially important in working with children with disabilities. ICTs are used at any stage of joint organized activities with students:

1. At the beginning of the lesson, digital technologies make it possible to introduce into the topic, actualize existing knowledge and ideas through creating a problem situation.
2. ICTs are often used to accompany the teacher's explanation (diagrams, drawings, presentations, video clips, etc.).
3. Hypertexts and electronic textbooks are used as information and training aids.
4. Tests in online mode or on electronic media are conveniently used to control the quality of understanding of material by children.

At the same time, there is a contradiction between objective necessity and the real level of ICT implementation in the educational process.

A number of authors studied the specifics of the perception of information from a computer or electronic books [3, 4, 10]. The superiority of touch screens over traditional books was written by N. Matasaka and others. However, according to S. Reich, J. Yau and M. Warschauer, teaching with adult's help and traditional printed texts is more productive, as animations and sounds with games distract children [3].

According to N.I. Pak, students perceive the same electronic text in different ways. The speed of reading and understanding the meaning of the educational text from the computer screen is largely dependent on its screen interface [4].

A contradiction arises between the useful features of the on-screen presentation of text to meet the individual needs of each student and the inadequacy of the theory and practice of developing an interface for electronic materials, where the characteristics of the "readability" of electronic text often come to the fore.

I. Sh. Mukhametzyanov considers the influence of ICT on humans, taking into account aspects of maintaining and developing health, describes the most common conditions and diseases, the development of which is facilitated by the improper use of computer technology [5].

This necessitates the search for a "middle ground" between the traditional approaches of developing education and the use of ICT.

## **2. RESEARCH METHODOLOGY**

Two groups of children took part in the experiment: 10 students with mental retardation (intellectual disabilities) and 20 students with normative development. The age of the subjects is 10-11 years.

The specificity of this study was that the study of visual perception, reading techniques and reading comprehension was carried out using images and texts in printed and electronic form (from a laptop monitor).

To study the features of visual perception among students on the material of a printed and electronic visual source, the following adapted methods were used:

1. The method "Find the difference" A. A. Osipova, L.I. Malashinskaya. Research procedure: the student is offered to find differences between two color subject images.

Evaluation of the results:

- low level - the student does not understand the task assigned to him, randomly manipulates the pictures. Task execution time more than two minutes;
- intermediate level - the student understands the instructions, but makes mistakes when completing the assignment; training assistance is required. Task execution time from one to two minutes;
- high level - the student understands the instructions and performs the task correctly. The task takes less than one minute to complete.

2. Methodology "Poppelreiter's figures".

Research procedure: the student is explained that he will be shown a drawing in which the objects known to him (as if outlined) are "hidden". Next, the student is presented with a drawing and asked to consistently name the outlines of all the "hidden" objects.

Evaluation of the results:

- low level - the student does not understand the task assigned to him, randomly manipulates the pictures. Task execution time more than two minutes;
- intermediate level - the student understands the instructions, but makes mistakes when completing the assignment; training assistance is required. Task execution time from one to two minutes;
- high level - the student understands the instructions and performs the task correctly. The task takes less than one minute to complete.

3. The technique of "Noisy images"

(A.R. Luria). Research procedure: the student is asked to recognize the crossed out objects shown on the sheet and name them.

Evaluation of the results:

- low level - the student does not understand the task assigned to him, randomly manipulates the pictures. Task execution time more than two minutes;
- intermediate level - the student understands the instructions, but makes mistakes when completing the assignment; training assistance is required. Task execution time from one to two minutes;
- high level - the student understands the instructions and performs the task correctly. The task takes less than one minute to complete.

4. The study of reading techniques and reading comprehension.

Research procedure: the student is invited to read the text and answer questions about its content.

Evaluation of the results:

1. For students with mental retardation (intellectual disabilities):

- low level - letter by letter reading, average reading rate up to 16 words per minute;
  - average level - a syllable way of reading, average reading rate from 31 to 40 words per minute;
  - high level - synthetic reading, average reading rate of more than 56 words per minute.
2. For students with normative development:
- low level - correct reading in whole words with observance of pauses and intonation, average reading rate from 74 to 86 words per minute;
  - average level - correct reading in whole words with observance of pauses and intonation, average reading rate from 90 to 125 words per minute;
  - high level - conscious, correct reading in whole words with observance of pauses and intonation, average reading rate from 130 to 150 words per minute.

### 3. RESULTS

Temporary performance indicators of tests for the study of visual perception in primary school children with mental retardation (intellectual disabilities) are presented in table 1.

The results of the study of visual perception on the material of printed and electronic sources indicate that when performing tasks presented in electronic form, students with mental retardation spent less time than when performing similar tasks in printed form.

A high level of task performance was observed in 7 students of this group when working with a printed image and in 10 children when working with pictures on electronic media.

The perception of contour images in both print and electronic form has not changed significantly, all students completed the task in less than 1 minute, which corresponds to a high level.

Recognizing "Noisy images" on electronic media in 7 out of 10 students was a little faster than on paper. The level of completion of tasks is high.

In addition, we noted that children with mental retardation (intellectual disabilities) showed greater interest in the tasks presented on an electronic medium (laptop), but could not explain the reason for their interest.

Indicators of reading speed and quality of reading comprehension by students with mental retardation (intellectual disabilities) are presented in table 2.

**Table 1** Temporary performance indicators for studies of visual perception in students with mental retardation (intellectual disabilities) in print and electronic media (abs. In sec.)

Child No.	Method "Find the difference"		Method "Poppelreiter figures"		Method "Noisy images" (A.R. Luria)	
	print.	electron..	print..	electron..	print..	electron..
1	17	27	20	10	16	12
2	39	41	37	41	45	40
3	30	21	10	10	11	9
4	50	56	17	19	28	25
5	34	47	21	33	11	18
6	60	60	30	39	33	30
7	43	35	18	14	25	27
8	80	41	12	11	19	11
9	96	33	31	13	10	25
10	37	37	45	50	46	30
<b>Average</b>	48,6	39,8	24,1	24	24,4	22,7

Based on the data obtained during the study, students with mental retardation (intellectual disabilities) were conditionally divided into three groups according to the level of task performance.

A high level of reading technique and reading comprehension was shown by 4 out of 10 children. They were characterized by synthetic reading, during which the children observed syntactic and logical pauses, regulated the strength of the voice depending on the content of the text being read. On average, students in this group read

more than 56 words per minute. For 3 children, minor difficulties were noted in establishing logical connections in what they read and in assessing the events reflected in the proposed text. Also, two students of this group did not have gross distortions of the sound and syllabic structure of the word, one child had distortions of the sound and syllabic structure of two and three-syllable words (replacements, omissions and adding unnecessary sounds and syllables).

**Table 2** The main indicators of the study of the technique of reading and reading comprehension in students with mental retardation (intellectual disabilities) in print and electronic media (abs.)

Child number	Total words read per minute		Number of words read incorrectly		Number of words read correctly		Number of correct answers in the text	
	print..	electron..	print..	electron..	print..	electron..	print..	electron..
1	56	62	3	2	53	60	1	2
2	40	36	15	27	25	9	0	0
3	74	72	4	5	70	67	2	1
4	12	9	11	9	1	0	0	0
5	72	70	1	3	71	67	2	1
6	33	35	7	12	26	23	0	0
7	58	63	2	7	56	56	2	1
8	9	2	8	2	1	0	0	0
9	16	13	9	9	7	4	1	1
10	31	36	27	33	4	3	0	0
<b>Average</b>	<b>40,1</b>	<b>39,8</b>	<b>87</b>	<b>109</b>	<b>31,4</b>	<b>28,9</b>	<b>0,8</b>	<b>0,6</b>

The average level of reading technology and reading comprehension was shown by 3 primary schoolchildren with mental retardation. The average reading speed for this group of students is from 31 to 40 words per minute. Reading comprehension is much more difficult.

A low level of reading technology and reading comprehension were shown by 3 children. The reading speed of students in this group was up to 16 words per minute, while a large number of errors were noted. In children, letter-by-letter monotonous reading with blurry articulation was observed. There is no awareness of what is read.

During the study of reading techniques and reading comprehension, it was noted that the majority of students (8 out of 10) read the text presented in the printed classic version was easier than similar text presented in electronic form.

A study aimed at studying visual perception, reading techniques and reading comprehension using the methods described above was conducted with students with normative development. The results are presented in tables 3, 4.

Table 03. Temporary performance indicators of tests for the study of visual perception in students with an intellectual norm in print and electronic media (abs. In sec.)The data in the table indicate that when performing tasks according to the "Find the Difference" methodology,

presented in electronic form, 12 out of 20 students spent less time than when performing a similar task in print.

Recognition of contour images in the electronic version in time was a little longer, compared with the printed version in 12 out of 20 children.

Noisy images were recognized faster on an electronic medium by 16 out of 20 students.

Children in this group performed tasks at a high level regardless of the way visual material was presented.

It should be noted that students with normative development made the following arguments in favor of working on electronic media: on a laptop "it is easier and more enjoyable to complete the task"; "I liked it on a laptop, because it's more interesting, more complicated and I understand what is depicted"; "On a laptop, graphics are better seen."

But it was noted by some children that working with the printed version is better, because "the screen is shining, the radiation is unpleasant to watch" (the girl has a visual impairment, she has to wear glasses on an ongoing basis); "Better on the sheet, less smeared"; "It's better on paper, I don't like to look at the screen, it's harmful, I like the paper version" (the boy is engaged in art school).

Despite the high results of the assignment in electronic form, several students of this group preferred the classic printed version of the information.

**Table 3** Temporary performance indicators of tests for the study of visual perception in students with an intellectual norm in print and electronic media (abs. In sec.)

Child No.	Method "Find the difference"		Method "Poppelreiter figures"		Method "Noisy images"	
	print..	electron..	print..	electron..	print..	electron..
1	32	20	13	12	6	13
2	9	5	9	6	10	4
3	24	50	19	39	30	17
4	24	18	12	15	27	8
5	23	25	6	18	14	11
6	25	38	14	35	29	11
7	15	20	15	9	9	14
8	30	19	16	22	8	8
9	14	10	13	17	12	9
10	27	27	15	7	15	10
11	25	11	13	20	11	8
12	15	10	17	20	13	11
13	7	20	12	10	17	12
14	20	23	17	15	11	8
15	17	21	14	7	8	19
16	19	15	11	13	7	5
17	15	10	15	17	16	8
18	21	12	11	5	4	3
19	11	5	20	5	14	15
20	15	18	9	11	8	5
<b>Average</b>	<b>19,4</b>	<b>18,9</b>	<b>13,6</b>	<b>15,2</b>	<b>13,5</b>	<b>10</b>

**Table 4** The main indicators of the study of reading technology and reading comprehension students with an intellectual norm in print and electronic media (abs.)

Child No.	Number of words read per minute		Number of words read incorrectly		Number of words read correctly		Number of correct answers in the text	
	print..	electron..	print..	electron..	print..	electron..	print..	electron..
1	150	128	4	1	146	127	4	5
2	125	92	3	3	122	86	5	4
3	109	105	2	4	107	101	3	3
4	86	80	4	5	82	75	4	3
5	98	90	3	3	95	87	5	4
6	114	100	3	4	111	96	5	4
7	150	130	4	3	146	127	4	4
8	85	74	2	4	83	70	4	4
9	105	100	4	5	101	95	4	4
10	150	140	3	4	147	136	5	4
11	150	141	4	4	146	137	4	4
12	102	98	5	4	97	94	4	4
13	97	93	4	3	93	94	4	3
14	120	105	2	5	118	100	5	4
15	150	143	2	2	148	141	4	4
16	150	140	3	3	147	137	5	4
17	85	80	5	6	80	74	4	4
18	150	142	3	2	147	140	5	4
19	96	83	5	3	91	80	4	3
20	150	138	2	3	148	135	4	4
<b>Average</b>	<b>121,1</b>	<b>110,1</b>	<b>3,35</b>	<b>3,55</b>	<b>117,75</b>	<b>106,6</b>	<b>4,3</b>	<b>3,85</b>

Based on the study of reading techniques and reading comprehension, students with an intellectual norm were also conditionally divided into three groups according to the level of task performance.

A high level of reading technique and reading comprehension was shown by 8 students (average reading rate from 130 to 150 words per minute). They were characterized by a conscious, correct reading in whole words, observing pauses and intonation. Students understood well the text they read, the logic of the narration and could answer most of the questions on the content of the text (students gave answers to 4-5 of 5 questions). 4 out of 8 students of this subgroup expressed their attitude to the text.

The average level of reading technology and reading comprehension was shown by 9 students (average reading rate from 90 to 125 words per minute). They read consciously, correctly, in whole words, observing pauses and intonation. Students understood the text they read, the logic of the story and correctly answered most of the questions on the content of the text (students gave answers to 3-5 questions out of 5). At the same time, students made from two to five errors in reading.

A low level of reading technique and reading comprehension were shown by 3 students (average reading rate from 74 to 86 words per minute). In children of this subgroup, a conscious, correct reading in whole words was observed with observance of pauses and intonation. Students understood the text read, answered

questions, but could not express their attitude to the text read.

During the survey, it was noted that for all students with an intellectual norm, the reading rate in the printed version was significantly higher than in electronic.

#### 4. DISCUSSION

1. Children with mental retardation (intellectual disabilities) and normative development, showed higher motivation when completing tasks on an electronic medium.

2. Perception and work with color pictures on the monitor screen were more productive than with printed pictures by students of both groups.

3. Overlapping images were perceived faster with the help of traditional printed images by children with normative development, children with mental retardation (intellectual disabilities) did not show significant differences when performing this task.

4. The perception and recognition of noisy images on electronic media was more productive than on traditional print among children of both groups.

5. For most students with mental retardation (intellectual disabilities) and all students with normative development, the reading rate in the printed version was significantly higher than in electronic, the number of errors associated with understanding the read text was less when working with printed text.

#### 5. CONCLUSION

Thus, the features of the use of ICT in working with elementary school students both with intellectual disabilities and with normative development are determined by what kind of material (picture or text) is offered to children.

Students of both groups showed a higher motivation in working with electronic media, which can be used to

maintain cognitive interest in the lessons, especially in children with intellectual disabilities.

When using ICT tools, it is necessary to take into account the individual characteristics, preferences and health status of each child.

#### REFERENCES

[1] Andersen, BB, Brink, C. (2007), *Multimedia in Education [Mul'timedia v obrazovanii]*, Drofa, Moscow, 100 pp.

[2] Astrametskaya, N.P. (2018), "ICTs in inclusive education: features of integration and efficiency", *Digital transformation of education [IKT v inklyuzivnom obrazovanii: osobennosti integratsii i effektivnost"]*, Tsifrovaya transformatsiya obrazovaniya], Minsk, pp. 321-324, available at: <https://www.elibrary.ru/item.asp?id=35381041>.

[3] Vodyakha, S.A., Vodyakha, Yu.E., Minyurova, S.A. (2019), "Peculiarities of the Structure of the Intelligence of Junior Schoolchildren Studying through Gadgets" ["Osobennosti struktury intellekta mladshikh shkol'nikov, obuchayemykh posredstvom gadzhetov"], *Teacher Education in Russia*, No. 7, pp. 133-140.

[4] Lapchik, M.P. (Ed.) (2017), *Current Problems of Education Informatization [Sovremennyye problemy informatizatsii obrazovaniya]*, OmGPU, Omsk, 404 pp.

[5] Mukhametzyanov, I.Sh. (2017), *Medical Aspects of Education Informatization [Meditsinskiye aspekty*

informatizatsii obrazovaniya], IUO RAO, Moscow, 72 pp.

[6]. Ogneva, M.A. (2014), "Educational games as a means of speech correction in primary school children studying in special correctional classes", Theory and practice of education in the modern world: proceedings of the VI International Scientific Conference, (St. Petersburg, December 2014) ["Razvivayushchiye igry kak sredstvo korrektsii rechi u detey mladshogo shkol'nogo vozrasta, obuchayushchikhsya v spetsial'nykh korrektsionnykh klassakh", Teoriya i praktika obrazovaniya v sovremennom mire: materialy VI Mezhdunarodnoy nauchnoy konferentsii], Zanevskaya Square, St. Petersburg, pp. 215-218, available at: <https://moluch.ru/conf/ped/archive/145/6873/>.

[7] Soroko, E.N. (2015), Use of electronic resources in the correctional and educational process [Ispol'zovaniye elektronnykh resursov v korrektsionno-obrazovatel'nom protsesse], available at: [http://elib.bspu.by/bitstream/doc/22663/1/%D0%A1%D0%BE%D1%80%D0%BE%D0%BA%D0%BE%20-%20%D1%81%D1%82%D0%B0%D1%82%D1%8C%D1%8F\\_46\\_2015.pdf](http://elib.bspu.by/bitstream/doc/22663/1/%D0%A1%D0%BE%D1%80%D0%BE%D0%BA%D0%BE%20-%20%D1%81%D1%82%D0%B0%D1%82%D1%8C%D1%8F_46_2015.pdf).

[8] Chuprova, E.S. (2013), "The use of information technology in correctional work", Pedagogy: traditions and innovations: materials of the IV International Scientific Conference, (Chelyabinsk, December 2013) ["Ispol'zovaniye informatsionnykh tekhnologiy v korrektsionnoy rabote", Pedagogika: traditsii i innovatsii: materialy IV Mezhdunarodnoy nauchnoy konferentsii], Two Komsomol members, Chelyabinsk, pp. 75-78. available at: <https://moluch.ru/conf/ped/archive/98/4610/>.

[9] Robert, I.V., Lavina, T.A., Bosova, L.L. (Ed.) (2009), Explanatory Dictionary of the Terms of the Conceptual Apparatus of Education Informatization [Tolkovyy slovar' terminov ponyatiynogo apparata informatizatsii obrazovaniya], Binom, Moscow, 96 p.

[10] Masataka, N. (2014), "Development of reading ability is facilitated by intensive exposure to a digital children's picture book" ["Razvitiyu sposobnostey k chteniyu sposobstvuyet intensivnoye znakomstvo s tsifrovoy detskoy knizhkoy s kartinkami"], *Frontiers in Psychology*, No 5, pp. 5-8.