

# Use of Information and Communication Technologies in Working with Students with Multiple Complex Developmental Disorders

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## ABSTRACT

The article is devoted to the problems of implementing digital technologies in the education system of students with multiple complex developmental disorders (MCDD). The authors describe the matrix of the map of assessment of information and communication skills of students distinguishing the levels of their formation. Organizational conditions and recommendations for the use of information and communication technologies (ICTs) in the educational process are described. The author presents the directions of the teacher’s work on the development of information and communication skills in children with MCDD, considering the use of ICTs in four aspects: as a subject of study, as a means of education, as a means of correction, as a means of alternative communication. Possible and necessary directions of activity of teachers with students on the inclusion of ICT elements in the educational process and extracurricular forms of work for the development of elementary information and communication competence in children with MCDD are proposed.

**Keywords:** *information and communication skills, information and communication technologies for students with multiple complex developmental disorders*

## 1. INTRODUCTION

In modern conditions of education modernization, considerable attention is paid to the education and teaching of students with multiple complex developmental disorders (MCDD): various legal documents, scientific developments, national and social projects in the field of special and inclusive education are being developed and implemented. The category of children with MCDD is extremely diverse: a combination of sensory, motor, and intellectual disorders of varying severity.

Despite severe developmental disorders, children with MCDD develop in accordance with the pattern identified by L. S. Vygotsky and his followers, which is that the laws of development are the same for normal and abnormal children (children with developmental disorders). However, the law formulated by L. S. Vygotsky at the beginning of the 20th century had little effect on the practice of educating and teaching children with MCDD, many of whom were considered “unteachable” until recently. The term and concept “unteachable” has become a historical fact today. Children with MCDD received the status of students, fixed in the Russian legal framework in the following documents: “The Law on education in the Russian Federation”, “The Federal state educational standard (FSES) for students

with mental retardation and multiple complex developmental disorders”.

The concept of MCDD includes the concept of “children with disabilities”. In recent years, the education system, both general and special, has paid great attention to this category of students. For example, we will present the project “Accessible environment” that is currently being implemented. The implementation of the project has allowed many students with MCDD to get education at home, and in the context of educational organizations. In cases where home-based learning is unavoidable, distance learning technologies help the student. These technologies have been improved and are being improved year by year and occupy an increasing place in the life of society. Currently, the entire education system is switching to digital technologies that open up new horizons in the economy – the “Digital economy” project and in education - the national project “Education” and the Federal project “Digital educational environment” (DEE). In future, all educational organizations should have DEE by 2025, which will form a new generation - the generation of the digital age.

All students in modern conditions are already children of the digital age, because digitalization has had a gradual entry into people’s lives. In our country, information and communication technologies (ICTs) have become the forerunner of digital technologies. They, as a bridge to

digital technologies of the near future, should be mastered by students with MCDD.

According to the requirements of the Federal state educational standard for students with mental retardation and MCDD, a flexible and variable educational system should be created that takes into account special educational needs and individual characteristics of this category of students [7].

Meeting the special educational needs of students with MCDD is ensured by creating optimal conditions that promote their effective development. One of these conditions is the presence of special requirements for educational materials used in working with students. Such requirements, according to the existing regulatory documentation, are: the use of a variety of subject and visual didactic materials that illustrate the natural and social world; verbal and non-verbal means of communication, including electronic, including computer devices and related software [7].

The content of the educational process of students with MCDD includes an academic component and a component of life competence, and the latter should significantly prevail, since it provides for the acquisition of skills necessary for the student in everyday life. Achieving a positive result in the formation of these components of the educational program for students with MCDD contributes to the organization of an information environment that is adequate to the capabilities and needs of students, which will expand the area of educational space. In this regard, there is an increasing need to use information and communication technologies in various activities of children with MCDD. The formation of elementary information and communication competence of this category of students is a priority task of their education, since it allows them to master the available means of communication (verbal and non-verbal), learn to use alternative means of communication (the use of technical means), facilitate contact and maintain it [2,5,7]. The concept of information and communication competence (ICT) includes two components - information and communication. These concepts are quite widely represented in the researches of scientists (O. B. Zaitseva, E. I. Klimenko, G. V. Kruglikova, A. L. Semenov, etc.).

## 2. METHODS OF RESEARCH

To determine even greater opportunities for implementing ICTs in the educational process of students with MCDD, we'll turn to the research methodology. The research is based on historically proven approaches and directions in science:

- personality-oriented approach (E. V. Bondarevskaya, I. S. Yakimanskaya);
- activity approach (A. N. Leontyev), competence approach (I. A. Zimnaya, E. F. Zeer, A.V. Khutorskoy);
- ideas about the socio-cultural development of the individual and the laws of development of normal and abnormal children (L. S. Vygotky et al.).

In addition, it is necessary to analyze in more detail the effectively developing methodology of ICT in general and the methodology for the formation of ICT competences:

- ideas of modernizing education on a competence-based basis (O. E. Lebedev, A.V. Khutorskoy);
- concept of informatization of education (A. P. Yershov, G. A. Bordovsky),
- ideas of using ICTs in the educational process (E. S. Polat, A.V. Khutorskoy).

We'll look at the latest ideas and concepts in more detail. The concept of information and communication competence (ICT) includes two components - information and communication. These concepts are quite widely represented in the researches of scientists (O. B. Zaitseva, E. I. Klimenko, G. V. Kruglikova, A. L. Semenov, etc.). Information competence is considered as: a complex individual psychological education that integrates theoretical knowledge, practical skills in the field of innovative technologies and a set of personal qualities (A. L. Semenov); information literacy, including the ability to independently search and process information (T. Matveeva); a component of professional competence (A.V. Khutorskoy); the ability to find, evaluate, use and communicate information in its various types and representations (V. Nedbay). Common to many authors is the understanding of the need to develop information competence through the enrichment of knowledge, skills from the field of informatics and information and communication relations, the development of communication and intellectual abilities, and the implementation of interactive dialogue in cyberspace. Most often, researchers consider information and communication competences in unity [6, 9].

G. V. Kruglyakova describes information and communication competence as an integrative quality of personality, which is characterized by the ability to independently search, select the necessary information, analyze and present it, model and design objects and processes, implement projects in individual and group work. Information and communication competence as a system includes the following elements (or subsystems): working with information, entering and building optimal relationships with a communication partner, the ability to act in the space of information resources on the Internet, the ability to accept and transform, process information in the process of communication [4].

In the structure of information and communication competence, E. I. Klimenko identifies the following components: informational (the ability to perform various operations with information); communicative (the ability to build dialogic communication, the ability to work in a team); personal (the ability to make decisions independently, the development of research and creative abilities); spiritual and moral (the ability to regulate the behavior); technological (the ability to apply technical knowledge and skills to use modern means of information and communication technologies in various spheres of life and activity); linguistic (the ability to build grammatically correct sentences, form meaningful statements, correlate expressions with the corresponding socio-cultural

situation); professional (the ability to operate with specialized knowledge in the workplace); intercultural (the ability to implement all the above components of ICT in different socio-cultural systems and spaces) [3].

According to the research of S. M. Avdeeva, N. V. Nikulicheva, S. S. Khalayeva, O. I. Zaichkina, pedagogical ICT competence also deserves some attention, it affects all aspects of the educational process: the preparation and implementation of educational programs, the practical use of ICT tools in the process of education and teaching [11]. This issue is particularly relevant for students with MCDD, when the use of ICTs directly depends on the level and prognosis of children’s development, the nature and severity of their disorders.

**3. THE RESULTS OF THE RESEARCH**

Based on the provisions of the ICT competence methodology, we offer an algorithm for diagnostic work with students with MCDD, which precedes the correctional and developmental activities of teachers.

The initial stage of work on the formation of elementary information and communication competence of students with MCDD is the collection of diagnostic data regarding the initial level of its formation in students. The diagnostic tools in this case can be the following methods: a conversation with parents (legal representatives), a method of expert evaluation, systematic monitoring of students’ activities, specially organized tasks. The results of the implemented methods are entered in the diagnostic map, the analysis of which will determine the level of formation of information and communication competence of a student with MCDD at the stages of incoming, intermediate and final diagnostics.

The diagnostic map is based on the available cumulative data on the assessment of ICT competences in students and selected criteria for their formation in children of this category [8].

**Table 1** Matrix of the information and communication skills assessment map for students with multiple complex developmental disorders

№	List of skills and practical skills	Assessment of the level of formation			
		The skill is not formed	Performing using	Performs independently	
				Episodically	Constantly
I.	Information competences				
	...				
II.	Communication competences				
	...				

In the diagnosis of information and communication skills in students with MCDD, we apply the following list of skills and practical skills, combined in blocks:

Block I. Information competences:

- to have the skills to work with various sources of information, books and textbooks, reference books and catalogs, and CD-ROM;
- to find the necessary information from different sources (including the Internet) on a subject;
- to extract, systematize, analyze and select the information necessary for solving educational tasks, organize, transform, save and transmit it;
- to create files and folders to store the received information;
- to communicate in social networks: write a message to a remote communicator, share information, read responses to the messages;
- to use the received information to create a product (presentation, project);
- to create thematic presentations on the topic of the lesson, for events (public holidays, birthdays of relatives and friends)

Block II. Communication competences:

- to monitor the work and communication of adults on a computer / laptop;
- to watch adults turn on cartoons, games for children their computer / laptop;
- to open, turn on, turn off and close the laptop / computer;
- to be able to use the keyboard;
- to be able to use a computer mouse;
- to find the icons on the desktop: cartoons, games, pages in social networks of relatives.
- to play simple computer games;
- to find the icons and use them to switch on cartoons, games, pages of relatives and friends in social networks.
- to be able to represent themselves and their family verbally and in writing, fill out a questionnaire, write an application, and write a letter;
- to possess different types of speech activity (reading, writing);
- to master the ways of joint activity in a group, methods of action in situations of communication.

The obtained diagnostic data enable to distinguish the levels of formation of information and communication competence: zero, initial, medium and high.

Level zero implies the lack of skills and abilities to independently search for the necessary information (information competence) and the lack of basic skills of independent use of a laptop or with the help of an adult / computer (communication competence).

The initial level involves the ability to communicate in social networks with the help of an adult with the immediate environment (information competence) and the possession of basic skills of independent or, with the help of an adult, use of a laptop / computer (communication competence) (open, turn on, turn off and close the laptop / computer; the ability to use the keyboard and mouse) (pre-communication competence).

The medium level involves reading and writing skills, the ability to initiate a search for information (find the icons

to cartoons or simple computer games on the desktop (information competence), the ability to exchange information independently or with the help of an adult (communication competence).

A high level implies the skills to work with various sources of information, find the necessary information on a particular question, extract, systematize and select information and further save it in created files and folders (information competence) and the skills to use ICTs to create a product (presentation, greeting card, project) (communication competence).

The use of ICTs in working with students with MCDD requires certain organizational conditions that must be created both in the educational organization and at home:

- availability of Internet communication services at the student's residential address;
- availability of a computer or a laptop;
- use of a computer or a laptop as a technical tool by the student's immediate environment (parents, siblings);
- basic initial knowledge, skills and practical skills (if possible);
- teacher's knowledge of information and communication competence (use of presentations in the classroom and outside of school hours);
- inclusion of parents in the process of development and application of ICT competences by the child;
- availability of special computer programs or a library of electronic games and exercises to include them in the educational process in order to develop the mental processes of students;
- use of alternative communication systems in the process of interaction with the student (in situations where this is the only effective way to communicate);
- creation of certain products by the students themselves using ICT tools.

The use of computer games in the process of working with students with MCDD requires a special approach. Thus, Yu. V. Borblik, O. A. Shabalina, reviewing research on the use of gaming computer technologies in the educational process of students with mental retardation (intellectual disorders), offer recommendations to developers of computer games and identify several groups of software functionality, taking into account the psychophysical and intellectual characteristics of the contingent [1,10]:

- organization of levels and complexity of the game (increasing the level of difficulty from simple to difficult; providing users with the ability to return to previous levels or actions);
- input of information (allowing information to be entered in alternative ways; providing simplified game management);
- graphic design (use of unambiguous text, limiting the number of words, reducing extraneous noise for maximum user concentration on the main object);
- sound design (providing the possibility of turning off, repeating and adjusting the sound during the game, simultaneous text and sound versions of the instructions).

#### **4. DISCUSSION OF THE RESULTS**

Based on the approaches mentioned above and taking into account the specifics of disabilities of students with MCDD, it is possible to identify areas of activity of the teacher on the use of ICT tools with this category of students, which includes the following aspects:

##### *- ICT as a subject of study*

It involves familiarizing students with MCDD with a variety of technical tools (computer, laptop, tablet, phone, interactive whiteboard, etc.) and forming skills to use them. The work of the teacher in this aspect can be built in the following areas: development of interest to technical means and the desire to work with him, building skills right on and off, developing the ability to use the mouse or touch screen, the ability to find on the screen the desired icon (or document) and open it, etc.

The teacher's work in this direction includes the following stages: 1) the organization of students' watching an adult work with technical means (the important point at this stage is encouragement of the child: the inclusion of cartoons, demonstration pictures, videos, etc.), 2) training to switch on or off the computer by the method of conjugate action (which is gradually transformed into the student's independent action with the dosed help of the teacher), 3) training of skills of work with a mouse and a keyboard, 4) ability to select and open the desired program / icon / document (at this stage the work is organized in the following directions: work with an icon (when there is only one presented on the desktop); for positive motivation of the child it is advisable to start involving the start of his/her favorite game, cartoon, etc.; then the child's attention is drawn to some two icons on the desktop of the computer (there are only two, no more) and the skill of selecting the needed icon is worked through), 5) training in techniques of search of the necessary document (program). Within each stage, the work is based on the following algorithm: conjugate actions, semi-conjugate actions, actions with the guidance of the teacher, independent actions of the student).

##### *- ICT as a learning tool*

The activity of the teacher in this aspect can be divided into two areas. The first direction is the use of ICT tools in lessons, classes, and extracurricular activities as an additional means of teaching, demonstrating information in order to improve the effectiveness of the educational process. In this case, the student perceives and works with information prepared by a teacher (or specialist) taking into account the special educational needs of the child. An example is the use of presentations, audio text, and video clips to increase the level of formation of ideas about the surrounding subject and social world with students with MCDD. The second possible and necessary direction of the teacher's activity on the use of ICT tools in this aspect is organization of students' work with technical means to achieve a variety of educational tasks. To do this, the following can be implemented: performing tasks for students on an interactive whiteboard, independent searching and selecting information by subject areas, playing games using technical means in lessons and

correctional classes. In this context, project activities can be implemented with students with MCDD, since the project can be implemented using ICT tools. It should be noted that the creation of various projects by students with MCDD is an effective means of forming their competences at various levels: information, communication, social and everyday, and so on. The variability of projects will make it possible to achieve positive results in the process of training and education of this category of students in mastering both the academic component and the component of life competence, since this type of work requires a certain level of independence from the child and is associated with activities that have everyday significance for the student. The choice of the project topic should be determined by the subject or social significance for the student. Due to the limitations that students with MCDD have in all spheres of life, one of the most effective areas of project activity is the creation of projects on social and everyday orientation. For example, creating a project using ICT tools to prepare a dish will include the following activities of the teacher and the student: determining the components of the dish (searching the Internet for a recipe), determining financial costs (analyzing the sites of grocery stores located near the student's place of residence), determining the cooking technology (drawing up a detailed algorithm), and practical implementation of the project.

*- ICT as a means of correction*

It takes into account the need for correctional orientation of education of students with MCDD. For the development of

cognitive processes, visual-motor coordination, etc. specialized computer programs can be used in the lesson. Examples of such programs for improving reading, counting and writing skills can be "Fun ABC", "Learning to read", "Magic ABC book", "Russian for kids", "Pathfinders. Riddles of mathematics" and others. In order to optimize mental processes and mental operations, it's possible to use programs such as "Magic chest", "Razvivayka for first-graders", "Play with the tiger", etc.;

*- ICT as a means of alternative communication*

It involves the use of ICTs in order to improve the communication competence of students with MCDD. In this context, it is possible to train a child to use social networks, e-mail, and software on phones. These skills include the ability to find the right social network, the right account, the ability to log in to your account, to watch someone else's page, and the ability to write and receive a message. If the student has not developed writing and reading skills, it is possible to learn how to communicate via voice messages and so on. If the speech of students is characterized by a low level of formation or lack of communicative function, it is possible to use special communicators and learn skills to work with them. The service govori.org can serve as an online communicator. The communicator is presented as a library of graphic cards with text and audio accompaniment. The cards are grouped into 845 categories, but the user can also create their own ones. It is possible to use these sets to create offers and voice them. Also govori.org enables to create and print templates that can be used in everyday life.

## 5. CONCLUSION

In this study, we propose meaningful directions of the teacher's work on the use of information and communication technologies with students with MCDD, who may have difficulty obtaining the necessary information and interacting with others. Creation of the necessary conditions in educational institutions and in the family, implementing and testing ideas will enable to provide quality and accessible education, the extension of

the subject-practical and social experience, to develop skills required for everyday life of students with multiple complex developmental disorders.

For this category of students and for facilitating the work of teachers and parents with them, we have proposed algorithms for diagnostic and correctional and developmental activities.

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