Цифровые инструменты оценки образовательных достижений обучающимися с ограниченными возможностями здоровья в условиях инклюзивной образовательной среды

**Введение.** Изучение проблемы внедрения инклюзивной практики в систему российского образования рассматривается как инновационный процесс, который ориентирован на создание новой школы – школы для всех. Как любая инновация, инклюзия не только вносит в образовательный процесс школы новые элементы, но и определяет проблемное поле для исследования. Сложившийся мировой опыт становления инклюзии как позитивной социальной модели позволяет предположить, что эта практика станет жизнеспособной в российском обществе в целом, и в образовании, в частности.

**Цель представленного исследования** заключается в анализе существующей практики оценки образовательных достижений детей с ОВЗ и определении наиболее эффективных цифровых инструментов, адаптированных к современному инклюзивному пространству.

**Материалы и методы.** Методический инструментарий исследования содержит анализ научной литературы, посвященной проблеме оценки достижений учащихся в инклюзивной школе, изучение и интерпретацию научных трудов российских и зарубежных ученых и практиков. Кроме того, пакет методических материалов содержит разработки, позволяющие уточнить необходимость целенаправленной работы в аспекте повышения профессиональной компетентности педагогов в области оценивания образовательных результатов детей с особыми образовательными потребностями и формирования ценностного отношения к ним. Использованы данные поиска из библиографической базы Scopus (Elsevier) за 2019–2021 гг. по ключевым словам inclusive education AND digital learning.

**Результаты.** Выявлены наиболее эффективные цифровые инструменты оценки образовательных достижений детей с ОВЗ, которые используются в зарубежной и российской практике инклюзивного образования (e-inclusion, MyTestXPro, E-school bag и др.). Анализ потенциальных возможностей цифровой среды в обучении детей с особыми образовательными потребностями показал, что цифровые технологии значительно повышают потенциал обучающихся.

**Заключение.** Использование цифровых инструментов оценки образовательных результатов детей с ОВЗ открывает большие возможности и для совершенствования образовательных педагогических методик, интерактивности обучения, обмена опытом и творческого подхода к обучению в инклюзивном образовательном пространстве. Теоретический и практический анализ потенциальных возможностей цифровой среды в обучении детей с особыми образовательными потребностями показал, что цифровые технологии значительно повышают потенциал обучающихся.

**Ключевые слова:** инклюзивное пространство, цифровизация, цифровые инструменты оценки образовательных достижений детей с ОВЗ

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Digital tools for assessing educational achievements by students with disabilities in an inclusive educational environment

**Introduction.** The study of the problem of introducing inclusive practices into the Russian education system is seen as an innovative process that is focused on creating a new school – a school for all. Like any innovation, inclusive education not only introduces new elements into the educational process of the school, but also defines a problematic field for research. The current world experience in the development of inclusion as a positive social model suggests that this practice will become viable in Russian society in general, and in education in particular.

Presented study was set to analyze the existing practice of assessing the educational achievements of children with disabilities and identify the most effective digital tools adapted to the modern inclusive space.

**Materials and methods.** The methodological research tool contains such methods as an analysis of the scientific literature on the issue of assessing the achievements of students in an inclusive school, the study and interpretation of scientific works of Russian and foreign scientists and practitioners. In addition, the package of methodological materials contains research tools that make it possible to clarify the need for targeted work in the aspect of increasing the professional competence of teachers in the field of assessing the educational results of children with special educational needs and the formation of a value attitude towards them. We used research data from the bibliographic database Scopus (Elsevier) from years 2019 to 2021 using keywords inclusive education AND digital learning.

**Results.** The most effective digital tools for assessing the educational achievements of children with disabilities, which are used in foreign and Russian practice of inclusive education (e-inclusion, MyTestXPro, E-school bag, etc.), have been identified. An analysis of the potential of the digital environment in teaching children with special educational needs has shown that digital technologies significantly increase the educational potential of students.

**Conclusion.** The use of digital tools for assessing the educational results of children with disabilities opens up great opportunities for improving educational pedagogical methods, interactive learning, sharing experiences and a creative approach to learning in an inclusive educational space. Theoretical and practical analysis of the potential of the digital environment in teaching children with special educational needs has shown that digital technologies significantly increase the potential of students.

**Keywords:** inclusive space, digitalization, digital tools for assessing the educational achievements of children with disabilities

**For Reference:**

The success of the world community in passing through the current bifurcation moments of its development, such as the COVID-19 pandemic, the problem of social inequality, the environmental and economic crisis and political destabilization, depends on a set of objective and subjective decisions, one of which is the attitude towards young people with special educational needs associated with disabilities. Inclusive growth is a key principle in impulsing the effects of a sustainable development strategy, measures the dynamics of the functioning of social ecosystems in a complex and systematic way, and brings to the fore the problems of depreciation of human potential and measures to overcome them.

Inclusive thinking, as a product of anthroposociocultural evolution, expands the boundaries of human rights with disabilities, especially in the context of global digitalization. However, to some extent, the individuality of personal development is being erased by the possibilities of the latest information technologies and the automation of the technosphere as a whole, which is an insoluble contradiction of modern inclusive education. It is necessary to find common ground between global digitalization and an inclusive approach that will repeatedly improve the learning process for people with disabilities [1].

Analyzing the scientific works of foreign and Russian scientists devoted to the theoretical and practical aspects of the digitalization of an inclusive educational space, we can conclude that over the past decade, most of them describe the specifics of the distance form of education for children with disabilities (for example, conducted by Cinquin P., Guitton P., Sauzéon H. a review of studies on the features of online learning for people with cognitive impairments [2], a study by Dahlstrom-Hakki I, Alstad Z., Banerje M., in which the authors compare the effectiveness of synchronous and asynchronous online discussions in teaching people with disabilities [3], and much less studies are focused on the practice of introducing digital tools for assessing the educational achievements of people with disabilities in the context of an inclusive space in the pedagogical process.

Thus, the Canadian professor of the University of British Columbia T. Bates in his scientific work "Teaching in the Digital Age" analyzes the current trends in the digitalization of the education system, in particular aspects of the introduction of distance technologies and their impact on the quality of education [4]. In addition, T. Bates focuses on the need for a comprehensive modeling of the process of professional activity of a teacher of the
“digital age”, taking into account the difficulties that arise. The author emphasizes that the introduction of "digital innovations" in the educational process is accompanied by a complex of difficulties, but at the same time it suggests new opportunities. Interesting, in our opinion, is a detailed description of the barriers that arise when introducing digital innovations into an inclusive educational space:

- cognitive (complexity of perception of "digital" information);
- content (programming language does not coincide with traditional pedagogical content);
- didactic (lack of facilitation skills (digital literacy) of transferring information from a teacher in an inclusive space);
- financial (lack of funding for the latest technologies and digital tools for assessing the quality of education) barriers.

German researchers of the Technical University (Dortmund) Marci-Boehncke G., Vogel T. have developed a promising project "Youth-Media-Education", which reveals to teachers the possibilities of digital applications most adapted for teaching children with disabilities [5].

According to Bucksch, who presented in his scientific work the practical experience of implementing a digital storytelling course for students studying to become teachers in the special education specialty, discussing fairy tales helps children with special educational needs to enrich and stimulate the imagination, learn to recognize real difficulties and find options. overcoming them [6]. As an effective tool for language development and vocabulary enrichment, digital storytelling plays a social, cognitive and emotional role in teaching children with disabilities. The experiment conducted by the author on the introduction of a 36-hour course on digital storytelling confirmed the effectiveness of the applied methodology and was taken as the basis for subsequent educational and methodological developments.

Benavides-Varela S. et al conducted a meta-analysis of empirical data on the effectiveness of digital interventions for students with math learning difficulties. The results of the study show that digital interventions have a positive impact on the performance of students with intellectual disabilities in mathematics. According to the authors, the introduction of digital technologies can be seen as an appropriate tool to help children with learning difficulties in mathematics, able to offer additional opportunities to perform mathematical tasks in an alternative technological context. Moreover, according to the study, digital tools improve computational performance and numerical understanding to the same extent in children with intellectual disabilities in primary school and in preschool children [7].

A group of researchers from Taiwan developed and tested a game-based assisted teaching system (GBATS) in special education aimed at correcting visual perceptual dysfunction in children with developmental disabilities. According to the experiment, after the intervention, the group of students, in whose learning process the GBATS system was used, significantly exceeded the control group in all the studied parameters (Visual Perception Test, the Vineland Adaptive Behavior Scale and the School Function Assessment) [8].

A study by George Mason University researchers examined the impact of a Computer Graphic Organizer (CBGO) with built-in Self-Regulated Learning (SRL) strategies on humanities and science reasoning essay writing by 4th and 6th grade students in an inclusive space. The results showed that all students, regardless of their abilities and educational needs, performed better in terms of quality when using CBGO with built-in SRL strategies. There were statistically significant differences between the experimental group who used CBGO and the control group who received traditional paper writing instructions [9].
The preparation of teachers for the organization of an inclusive educational process is one of the urgent problems of modern education. Brazilian scientists from the University of Caxias do Sul have developed and tested the virtual learning object (LO) Incluir – a digital resource, as an additional tool for teacher training, aimed at promoting inclusive reflexivity of teachers and acquiring new meanings by teachers based on existing experience. The authors concluded that LO Incluir is a valuable additional resource that promotes teacher training in the organization of an inclusive educational space [10].

Garrison et al. [11] offer non-standard approaches to solving the problems of digitalization of inclusive education, in particular, the development of a multimedia digital project in which children with disabilities participate each at their own pace and in accordance with their capabilities, offering a personal contribution to the history of the creation of the chosen field social realization – arts, sciences, cultures, technologies, etc.

With this project, the authors answer the questions posed:

- how does a multi-thematic project stimulate the student to move to a higher cognitive level of critical thinking?
- how does the current project contribute to revealing the talent and uniqueness of each student?
- what conditions contribute to the creation of social networks of cooperation within the educational ecosystem?

Digitalization, of course, acts as a tool for global transformation, revealing its potential in the field of preserving and increasing human capital. Let us consider in more detail the large-scale digitalization projects of the inclusive space in the context of the global economic crisis (Table 1).

**Table 1**

<table>
<thead>
<tr>
<th>World projects for the development of inclusion</th>
<th>Characteristics of ongoing events</th>
<th>Reflection in the realities of inclusive education</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Concept of Inclusive Growth</td>
<td>Ranieri, Ramos (2013). Inclusive development as an instrument of political justice. Economic growth and equity do not contradict each other, and the reduction of inequality and poverty contributes to the development of communities [12].</td>
<td>Improving Education in: a) Access b) Quality c) Equality. The quality of the education system is assessed in terms of the level of student proficiency and Internet skills.</td>
</tr>
<tr>
<td>Inclusive Development Index</td>
<td>Proposed at the World Economic Forum in Davos (2018). An alternative to the index of physical volume of GDP. Brings to the fore the equal opportunities for all citizens to have access to the necessary resources to develop their potential. The state, society and business together bear joint responsibility for the development of communities, allow assessing the level of socio-economic development [13; 14]</td>
<td>The index is calculated on the basis of 12 indicators, which are divided between into three groups: - growth and development; - inclusiveness; - sustainable development. Inclusion index: assessment of the effectiveness of the process of organizing inclusive education, development of more effective models of inclusive education in a particular educational institution.</td>
</tr>
<tr>
<td>SDG - Creating an Inclusive Space</td>
<td>The creation was stimulated by the United Nations. Formation of an inclusive-conditioned system of worldview attitudes that guide the world community towards a &quot;better and more sustainable future for all.&quot; The Sustainable Development Goals are permeated with inclusive transformations aimed at overcoming existing discrimination [15].</td>
<td>United Nations Sustainable Development Agenda Sustainable Development Goals (hereinafter SDG) for the period up to 2030 - the goals of regional inclusive and integrative educational and social practices to preserve human and social capital was introduced.</td>
</tr>
</tbody>
</table>
European project "Education without limits: inclusion and integration"

National professional associations of social workers, educators, psychologists and doctors.

Promotes the development of a holistic and transforming education, including multi-aspect correctional and multi-level medical and pedagogical components. New trending practices of personnel training in the "digital university – digital region" system are being implemented.

At the same time, the digitalization of the process of inclusive education is accompanied by a complex of risks of authorization and interfaceization, which are becoming a form of communicative subjectivity of the 21st century. In the process of digital communication, which is most manifested in social networks (posts - reposts, likes, dislikes, selfie portraits, etc.), personal alienation can occur, not accepting oneself and the characteristics of one's health, as well as the formation of a fictitious interface of a "standard" healthy person.

In addition, the issue of independent choice of digital content by students in the process of using information remains a risk. Artificial intelligence, analyzing the activity of users, independently selects and offers sources of information, publications, events, based on the individual characteristics and preferences of the individual [16]. In addition, artificial intelligence promotes event importance management content. The implementation of such a scenario with a high degree of confidence ensures a significant decrease in the degree of independence of students in the processes of individual consumption of information, as well as the loss of skills and competencies for conscious work with information and the formation of objective ideas about reality.

An analysis of the practice of using digital diagnostic tools in the medical, educational and scientific fields allows us to assume that the potential of using computer programs in the field of diagnostics, psychodiagnostics, in child neuropsychology, although not yet fully realized, is rapidly being revealed in the world's best practices. On the example of foreign practice, it can be noted that the use of computerized programs in psychodiagnostics (CNS Vital Signs, CAT Cambridge Automated Testing, ANAM, CANS-MCI) is relevant and in demand [17]. At the same time, Russian-language computerized methods are rarely presented in the form of hardware and software systems and most often represent single software. Basically, the Russian market is represented by software, which is a computer version of the classic blank methods [18]. Nevertheless, research continues in this direction, which has taken shape in an independent area of research, called computer psychodiagnostics [19; 20].

Digital technologies are actively used in the diagnostic work of teachers at various levels of education: computer programs are used to diagnose the mental development of children studying in preschool institutions [21], to diagnose the formation of subject and meta-subject results, cognitive activity and personality of schoolchildren, as well as to identify the level of formation of competencies of students of higher educational institutions [22].

The development of teaching tools for children with psychophysical developmental disorders has always been considered as an important direction of scientific work in Russian and foreign special pedagogy. Over the past decades, Russian special education has accumulated significant theoretical and practical experience in the use of computer technology. In a special (correctional) school, digital technologies are considered as a significant tool for modeling the developing environment, as a way to expand the temporal and spatial boundaries of special education [23].

However, despite the fact that a fairly large number of studies have been devoted to the use of digital technologies in special education, developmental and educational activities
with children with disabilities, there is insufficient use of the potential of digital technologies in the diagnostic activities of a teacher.

This phenomenon may be due to the presence of psychological barriers to the introduction of digital technologies in educational institutions with low digital literacy of students with intellectual disabilities, due to the fact that most of the existing solutions are not adapted for diagnosing children with intellectual disabilities [24].

It is also noted in modern studies that digital technologies are used by speech pathologists mainly for lesson planning, selection of software for educational purposes, search for educational materials, however, these technologies are practically not used by defect pathologists in the classroom and as homework. In addition, the use of digital tools is hindered by the fact that the performance of actions with electronic models of objects differs from the performance of actions with objects.

However, according to the researchers, this is not an insurmountable obstacle to the use of digital tools in diagnostic and correctional development work.

The purpose of the presented study is to analyze the existing practice of deploying inclusive initiatives in various areas of life, to determine the most effective digital tools for assessing the educational achievements of children with disabilities, which are used in foreign and Russian practice of inclusion, as well as in the development of proposals that are most adapted to the modern inclusive space.

Solving the problem of adequate assessment of existing digital tools for assessing the educational achievements of students is most productive by means of ontological, axiological and environmental methodological approaches. In addition, as a method of the presented study, a search was undertaken on the Scopus platform (Elsevier) for 2019–2021. by keywords inclusive education AND digital learning. A thorough analysis of the articles made it possible to identify the most effective digital tools for assessing the educational achievements of children with disabilities, which are used in foreign and Russian practice of inclusive education.

Materials and methods

Solving the problem of adequate assessment of existing digital tools for assessing the educational achievements of students is most productive by means of ontological, axiological and environmental methodological approaches.

The ontological approach proceeds from the need to strengthen the digital potential of an inclusive educational space that contributes to the active comprehension of new horizons of knowledge. The principles of ontology help to overcome the existing contradiction between the total technologization and digitalization of being, the associated "depersonalization" of individuality, its irreversible replaceability, and the need to preserve one's own initiative series, originality, disclosure of resources and potential of a student with disabilities.

The axiological approach allows us to analyze the changes in the value-semantic foundation of human existence, which contributes to the assertion of the ideas of the unconditional value of each person for the survival of the entire human society. The axiological approach forms a set of beneficial conditions that ensure the harmonious adaptation of a student with special educational needs to the paradigm changes in value imperatives associated with the global digitalization of modern society.
Acting as a humanistic methodology, the environmental approach, based on specialized diagnostic procedures, creates starting points for basic pedagogical acts, creating a fruitful environment for a particular student with disabilities with a deterministic result. The temporal and spatial scale present in the process of implementing the environmental approach ensures the self-regenerability of positive sustainable results, cultivates an educational environment with specified characteristics.

In addition, as a method of the presented study, a search was undertaken on the Scopus platform (Elsevier) from 2019 to 2021 by keywords inclusive education and digital learning. A thorough analysis of the articles made it possible to identify the most effective digital tools for assessing the educational achievements of children with disabilities, which are used in foreign and Russian practice of inclusive education.

**Results**

Digital innovations significantly increase the effectiveness of traditional pedagogical methods and techniques, as well as accelerate the emergence of pedagogical innovations that have a significant impact on the pedagogical process in the framework of distance learning for children with disabilities.

The global popularization of digitalization of inclusive transformations actualizes the importance of inclusion as a philosophy of independent life, which is becoming important in an era of social change. This approach focuses on the ability of each person, including those with disabilities, to lead an independent lifestyle.

As a result of comparing digital tools for assessing the educational abilities of students with disabilities in Europe, Russia and the United States, positive and negative effects from their introduction into the educational process were revealed (Table 2).

**Table 2**

Overview of popular digital inclusion tools in different countries of the world

<table>
<thead>
<tr>
<th>Country</th>
<th>Digital tools for assessing educational outcomes</th>
<th>Characteristic</th>
<th>Positive effects of implementation</th>
<th>Negative effects of implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td>Phenomenon-based learning</td>
<td>Introduction of programming, hacker marathons and exhibitions of handmade devices.</td>
<td>1. Cognitive habits and structures required for literacy in the design and development of high-value decisions differ from habits and structures supported by mathematics, science and other elements of the traditional curriculum [25]. 2. The student, not the teacher, chooses the topic or phenomenon to be studied. 3. Teachers graduate from universities.</td>
<td>Lack of programming in elementary school.</td>
</tr>
<tr>
<td></td>
<td>AR programs</td>
<td>Students just need to scan flashcards from their smartphones and ABCs and explanations come to life.</td>
<td>1. Develop emotional intelligence. 2. No additional diagnostic tools are required [26].</td>
<td>Software failures.</td>
</tr>
<tr>
<td>Country</td>
<td>Service/Tool</td>
<td>Description</td>
<td>Features/Notes</td>
<td></td>
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<tr>
<td>------------------</td>
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<td>-----------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Slovenia</td>
<td>E-school bag</td>
<td>Electronic interactive textbooks on mathematics, the world around us, literature, etc. Includes a variety of tests and assignments. The child’s digital assistant helps to assess the child’s educational progress [27].</td>
<td>Very expensive technology (it is necessary that each child has his own)</td>
<td></td>
</tr>
<tr>
<td>The Republic of Korea</td>
<td>Cyber Home Learning System, CHLS</td>
<td>A distributed IT learning management system designed to continue the learning process after returning from school. 1. Each textbook contains curriculum content with interactive learning materials such as videos, links to external resources, and other information, as well as tests and diagnostic/prescription information. 2. The system provides &quot;smart&quot; diagnostics and provides remote counseling [28].</td>
<td>1. High occurrence of Internet addiction. 2. Highly qualified teachers who are able to analyze and interpret the results are required.</td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>Integrated Learning System - ILS</td>
<td>Educational and diagnostic tools Promoted as an effective means of education and diagnosis [29].</td>
<td>Efficacy has been questioned in a number of independent studies</td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>Eye tracking</td>
<td>Motion Tracking Devices eye Technologies with wide application: can be equipped with additional options for people with disabilities or vice versa, for example, a device that helps people orientate with sensory impairments finds demand in people without such impairments for the purpose of their spatial navigation [30].</td>
<td>Research in this area (regarding the application of such technologies in education) focuses mainly on studying the needs of special education teachers or teachers of general education schools for the benefit of technology developers, and not on studying the impact of these technologies on the learning process itself.</td>
<td></td>
</tr>
<tr>
<td>Russia</td>
<td>e-inclusion</td>
<td>The collection of digital devices and information and communication technologies Creation of interactive information environments, interactive whiteboards, tutorials, speech synthesizers, etc.</td>
<td>Expensive product</td>
<td></td>
</tr>
<tr>
<td>Russia</td>
<td>MyTestXPro</td>
<td>A software package that provides the development of electronic test tasks and the control of knowledge through tests 1. The ability to use different formats (test, task, image, sound) in one file and the ability to format files without leaving the program. 2. The ability to be trained and master programs at a convenient time for the student, from any device (personal computer, tablet, mobile phone), in the sequence that is necessary, interesting and understandable to a particular student.</td>
<td>Not commonly used</td>
<td></td>
</tr>
</tbody>
</table>

The purpose of the presented analysis was to identify and discuss digital tools for teaching and diagnosing educational achievements of students with disabilities in various countries, aimed at solving the specific problems of inclusion in the process of inclusive education. The retardation of Russian education from global digitalization trends is explained, among other things, by the fact that traditional tools for assessing educational results in the course of educational work are used much more often than digital tools that are
widely used in the inclusive educational space of Europe, North Korea and the United States. The introduction of the digital tools presented in Table 3, which have proven their practical effectiveness, would make it possible to mobilize and to a greater extent adapt educational work for students with special educational needs, organize diagnostics more authentically, design test tasks and procedures close to real life outside the walls of educational organizations.

It is necessary to model, develop and implement in the inclusive educational process high-quality and fairly complete collections of digital diagnostic materials, control and measurement tools and services for computerized assessment (including the State Academic Examination and the Unified State Examination).

A prerequisite for the effective implementation of digital technologies for assessing educational interests is the connection of educational organizations to high-speed Internet and the emergence of a developed digital infrastructure in them, which creates favorable conditions for automating the procedures for the formative and final (stating) assessment of educational achievements [30]. Scenario methods can be used here, which make it possible to objectify the assessment of both traditional academic educational results and the results of the 21st century. When checking freely constructed answers, artificial intelligence methods can be fully used here (for example, when performing tasks in native and foreign languages).

Methodically adequate digital tools for assessing educational results are the key to an effective response to the social demands of society and the students themselves, for whom it is also important to know the criteria for the qualitatively effective performance of their work in an inclusive space.

An important role for the organization of pedagogical activity in the digital environment is played by a well-designed ecosystem of the individual, the ecosystem of the individual in the conditions of the educational space.

The rapid global growth of digitalization of inclusive education, the widespread use of distance learning technologies makes technological platforms available, on the basis of which all interested parties can receive services such as a personal portfolio (digital twin), an intellectual assistant and a personal development trajectory.

**Electronic program** is an innovative form of information technology for accumulation, structuring, analysis and the possibility of introspection of the achievements of a student with special educational needs, which provides a continuous process of monitoring the child's personal development.

For example, the creation of a "portfolio" of a child with disabilities may include such modules as participation in creative competitions, the results of intellectual activity, products of the child's educational activities, etc.

The model of the content of the electronic portfolio of a student with special educational needs may include:

- **Block 1 – "Diagnostic"** – is filled with the results of questionnaires, surveys, versatile testing and other diagnostic methods to identify the level of learning material for students.
- **Block 2 – "Results of simulation games"** – simulation models are used and various aspects of the child's behavior are analyzed.

In this section of the electronic portfolio, you can monitor the educational success of students, strengths and weaknesses, which are noted in the Diagnostic block.
Block 3 – "Independent work of schoolchildren (extracurricular)" – includes the results of participation in competitions, work with electronic textbooks, allowing students not only to gain theoretical knowledge, but also to consolidate and improve practical skills in the discipline being studied, etc.

The use of digital tools for assessing the educational results of children with disabilities opens up great opportunities for improving educational pedagogical methods, interactive learning, sharing experiences and a creative approach to learning in an inclusive educational space. Theoretical and practical analysis of the potential of the digital environment in teaching children with special educational needs has shown that digital technologies significantly increase the potential of students.

This is confirmed by the PISA studies concerning the dependence of the “computer-student” ratio on the literacy of schoolchildren with disabilities. Thus, in countries with a low computer-to-learner ratio, literacy rates are lower than in countries with a high ratio.

For example, a study by Hye Jeong Kim, Pilnam Yi, and Ji In Hong used the 2018 International Student Assessment (PISA) student achievement data from 27 countries to define School Digital Inclusion (SDI) profiles. In inclusive schools, students living in the digital age benefit from the use of digital technology and the digital learning environment without experiencing alienation and isolation. Based on the results of the study, the authors argue that for the effective implementation of school digital integration, it is necessary to have such factors as the digital infrastructure of the educational organization, teachers’ confidence in the use of digital technologies and pedagogical competence, as well as developed skills in the use of information and computer technologies of teachers and students [31].

Intelligent assistant, or the so-called virtual assistant (intelligent assistant) is a modern technology for digitalization of the educational space, based on unique developments in the field of data mining, which have proven their effectiveness and received worldwide recognition at international conferences in Europe.

The informatized system is a multifunctional means of processing the available information, with the help of which the educational trajectory of a student with special educational needs is designed based on the results of diagnostic criteria and indicators.

The main task that the intelligent assistant solves is the constant intermediate diagnostics of the formation of the necessary knowledge, skills and abilities in order to timely identify deviations and the possibility of correcting the learning process.

The presented digital technology is effectively combined with the technology of the personal development trajectory, which involves the analysis of educational achievements in real time based on testing, with subsequent adjustment of the order of studying topics. Building the trajectory of personal development is a logical continuation of the forms of distance learning widely used at the present stage.

Thus, Indian researchers, having analyzed the current situation, point out both the existing advantages of such technologies (expanding access to global knowledge, the ability to “save” the materials studied, a certain measure for the prevention of viral diseases that are actively transmitted during collective work), and the difficulties and contradictions (lack of motivation, unwillingness to be at home most of the time, decreased interest in learning “alone, etc.).

The formation of a personal digital trajectory for a child with disabilities, a kind of digital track, will increase the efficiency of the inclusive education process.
Virtual reality tools allow you to test the ability of students to perform actions with objects. Peer assessment tools make it possible to evaluate individual components of a student’s portfolio, difficult to formalize components of behavior, which is often found in assessing the formation of leadership qualities, the ability to communicate productively, etc. With the help of modern data exchange protocols, it is possible to automatically return the results of computerized control to educational organizations, saving them in the work files of students. The digital tools and services listed and similar to them make it possible to objectify the results of educational work, to transfer responsibility for its progress and results to students. And teachers, freed from routine operations, can devote more time to educational work.

Discussion of results

The use of digital tools for assessing the educational results of children with disabilities opens up great opportunities for improving educational pedagogical methods, interactive learning, sharing experiences and a creative approach to learning in an inclusive educational space. Theoretical and practical analysis of the potential of the digital environment in teaching children with special educational needs has shown that digital technologies significantly increase the potential of students. We agree with Hye Jeong Kim, Pilnam Yi and Ji In Hong [14] that educators with disabilities living in the digital age benefit from the use of digital technology and the digital learning environment without experiencing alienation and isolation.

The lag of Russian education from global digitalization trends is explained, among other things, by the fact that traditional tools for assessing educational results in the course of educational work are used much more often than digital tools that are widely used in the inclusive educational space of Europe, North Korea and the United States.

The design of digital diagnostic (as well as educational) materials, services and tools is a fundamentally important component of the digital transformation of inclusive education, ensuring the transition to a personalized, productive organization of the educational process. It is here that they will be most in demand and able to significantly improve the educational process.

The creation and implementation of digital diagnostic tools and services require the formation of digital readiness and digital culture among teachers. Therefore, the introduction of digital tools for assessing educational results in children with special educational needs (primarily at the stage of trial operation and implementation) should be consistent with the development of the digital education infrastructure (technical equipment of educational organizations). Their effectiveness can and should be tested primarily on innovative platforms for digital education.

Let's summarize the problems of digitalization of inclusive education in Russia:

1. A transitional state from the previously dominant focus on the needs of special education to solving the problems of inclusion itself, the need to move from an individual to a social model.
2. Lack of personification of educational trajectories of students.
3. Teachers themselves oppose the introduction of digital technologies, in particular digital diagnostic tools, in the educational inclusive process, referring to the possibility of "digital dementia", "computer addiction" and a number of other "ills of globalization".
4. Problems of the emergence of social infantilism in an adapted society, social immaturity and limited opportunities to identify personal qualities and the level of knowledge in the learning process.

5. A narrow range of interaction in the system "students—information environment—teachers". At the moment, the use of various types of information resources for teaching children with disabilities is especially relevant. The analysis of digital tools for assessing the educational results of children with disabilities presented in the article not only reveals their positive and negative features, but also allows integrating the most effective information resources in the learning process, thereby expanding educational opportunities for children with disabilities.

Conclusions

Let us present the main conclusions characterizing the results of the presented study:

1. Analyzing the scientific works of foreign and Russian scientists devoted to the theoretical and practical aspects of the digitalization of an inclusive educational space, we can conclude that over the past decade, most of them describe the specifics of the distance form of education for children with disabilities, and much less research is focused on practice, implementation into the pedagogical process of digital tools for assessing the learning outcomes of persons with disabilities in an inclusive space.

2. It is necessary to model, develop and implement in the inclusive educational process high-quality and fairly complete collections of digital diagnostic materials, control and measurement tools and services for computerized assessment (including the State Academic Examination and the Unified State Examination). A prerequisite for the effective implementation of digital technologies for assessing educational interests is the connection of educational organizations to high-speed Internet and the emergence of a developed digital infrastructure in them, which creates favorable conditions for automating the procedures for the formative and final (stating) assessment of educational achievements.

3. The rapid global growth of digitalization of inclusive education, the widespread use of distance learning technologies makes technological platforms available, on the basis of which all interested parties can receive services such as a personal portfolio (digital twin), an intellectual assistant and a personal development trajectory. The electronic manual is an innovative form of information technology for accumulation, structuring, analysis and the possibility of self-analysis of the achievements of a student with special educational needs, which provides a constant process of monitoring the child's personal development.

4. Creating a "portfolio" of a child with disabilities may include such modules as participation in creative competitions, the results of intellectual activity, products of the child's educational activities, etc.

The model of the content of the electronic portfolio of a student with special educational needs may include:

Block 1 – "Diagnostic" — is filled with the results of questionnaires, surveys, versatile testing and other diagnostic methods to identify the level of learning material for students.

Block 2 – "Results of simulation games" — simulation models are used and various aspects of the child's behavior are analyzed.

In this section of the electronic portfolio, you can monitor the educational success of students, strengths and weaknesses, which are noted in the Diagnostic block.
Block 3 – "Independent work of schoolchildren (extracurricular)" – includes the results of participation in competitions, work with electronic textbooks, allowing students not only to gain theoretical knowledge, but also to consolidate and improve practical skills in the discipline being studied, etc.

The use of digital tools for assessing the educational results of children with disabilities opens up great opportunities for improving educational pedagogical methods, interactive learning, sharing experiences and a creative approach to learning in an inclusive educational space. Theoretical and practical analysis of the potential of the digital environment in teaching children with special educational needs has shown that digital technologies significantly increase the potential of students.

In the presented article, the most popular and frequently used digital tools and teaching and diagnostic technologies in the countries of Europe, North Korea, the USA and Russia were carefully analyzed in the process of inclusive education.

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