(RESEARCH ARTICLE)

ICT in inclusive education by AI blockchain technology

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Abstract

A new trend of digitalization of inclusive education for education in the framework of the UNESCO report "Futures of education. Learning to become". It was discussed how digitalization of education can make it more accessible for children with disabilities, studying in conditions of inclusion. The presented technology allows for a long time to consistently collect and analyze pedagogical, psychological, and medical information on the results of observations and examinations of each child for supervisory groups and consultations while maintaining full confidentiality of personal data.

The information collected serves as the basis for drawing up individual educational routes for the students, and for the teacher, it makes it possible to work in the zone of the children's closest development without comparing them with each other.

The presented development met with lively interest because the widespread introduction of inclusive practices in education is not always provided by the ergonomic technologies of the teacher, who has to work simultaneously with children with different educational needs.

Keywords: Blockchain; Education; Inclusion; Individual educational route

1. Introduction

Education for all is recognized by UNESCO as the basis for the transition to sustainable development. As for children with disabilities, "Education for All" is the way to eliminate discrimination in the educational process, the key to social justice, overcoming their social isolation, 11and the possibility of exercising rights to jobs. The global humane idea of human rights was born on the European continent under the influence of the consequences of World War II (Universal Declaration of Human Rights, 1948) when advocates of co-education for ordinary children and children with disabilities appeared. The "cult of utility" is transformed into a "culture of dignity", respectful acceptance, and support of people with disabilities. At the turn of the century, the first persons of several advanced powers called this direction of the educational process a priority concept [12].

The term "inclusion" was introduced into international circulation at the World Conference on the Education of Persons with Special Needs in Salamanca in 1994, held under the auspices of UNESCO, governments, and international organizations. In 2000, governments and international institutions adopted Education for All and the UN Global Agenda, which includes the Millennium Development Goals for universal primary education, which have now grown into sustainable development goals for the 4 Global Agenda until 2030.

Inclusion means that all children, regardless of their physical, mental, intellectual, cultural, ethnic, linguistic, and other characteristics, are included in the general education system and are trained at the place of residence with their peers

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without disabilities in the same general schools that consider their special educational needs and provide their students with the necessary special support. One of the inclusion goals is that any educational organization can accept children with different abilities [14].

The motto of inclusion may be the words: "Even if the voices of children sound differently, the right of every child to be heard is respected." Inclusion involves systemic changes in general, vocational, and higher education at three levels simultaneously: macro (politics, law, financing scheme), meso (municipal administration, schools), and micro (class, educational process). Therefore, this process is very complicated and responsible. And no country has yet reached the ideal. Learning and disseminating the best European experience is very valuable [4].

2. Materials and methods

The Salamanca Statement established that ordinary schools with an inclusive orientation increase the efficiency and, ultimately, the economic efficiency of the entire education system. A student attending special education requires more resources compared to the same student who attends regular school. However, at the local and school levels, adequate governance and financial support may be lacking to put the principles of inclusiveness into practice in national policies. The calculation of inclusion financing should take into account the costs of providing access to transport and premises, additional teaching staff, advanced training of teachers, development of scientific and informational, and methodological support for the educational process, it's monitoring. Therefore, Salamanca encourages governments, donors, and international agencies to invest in transforming educational systems toward inclusion. The allocation of resources in support of inclusiveness implies the existence of coordination mechanisms between ministries and government at various levels. Funding mechanisms should also be considered that encourage the inclusion of some students with SEN, as this gives schools with such students reasons to receive additional funds [14].

Although the current situation of students with complex support needs may be disappointing, 111some promising future trends may lead to the vision of Article 24 of the CPI in European countries [15].

The main proposals for different participants can be summarized as follows:

All states must fully implement Article 24 of the CRPD, including their general remarks and the relevant concluding remarks.

States should work with civil society to clarify and promote the idea of inclusive education for teachers and principals, as well as to ensure appropriate training and support. It is also necessary to support and promote research that proves that all children benefit from inclusive schools and that no child has lower grades.

States should invest more in inclusive education, both at the infrastructure level and at the level of teacher training and additional human resources at the school level. They need to close special education for all groups of students and fully invest these resources and experience in creating inclusive basic education for all. The abolition of special education should be carried out in such a way as to ensure that no child is left without a school. States should ensure that the knowledge and teaching methods of individual curricula are available within the framework of the primary school system and that ordinary teachers and supporters are trained and encouraged to use them. States and civil society should promote inclusive schools and their work. States should develop and support opportunities for connections, study trips, training, and the comprehensive support of ambitious people, including teachers, family members, and school principals [15].

The States, civil society, and the CRPD Committee should closely monitor the condition of all children who do not attend school to ensure that their right to education is not violated.

States should provide financial support to families with difficult support needs so that their children can attend regular schools without losing disability benefits or compensation.

The states must provide the necessary funding for the specific support that students with complex support needs need. Educational organizations

3. Results

The school authorities should strive to expand the inclusive capacities of comprehensive schools as a whole 111to enable inclusive education even for children with complex support needs.

School authorities should invest in the time of staff and show administrative flexibility in the use of human resources during the process of teaching a child. You also need to make sure that the technical means are available and that they are adequate if necessary.

Education administrations need to ensure that curricula are flexible enough to allow for true personalization and inclusivity. This also means that teachers receive the support they need for the specific implementation of individual and flexible curricula in their classes.
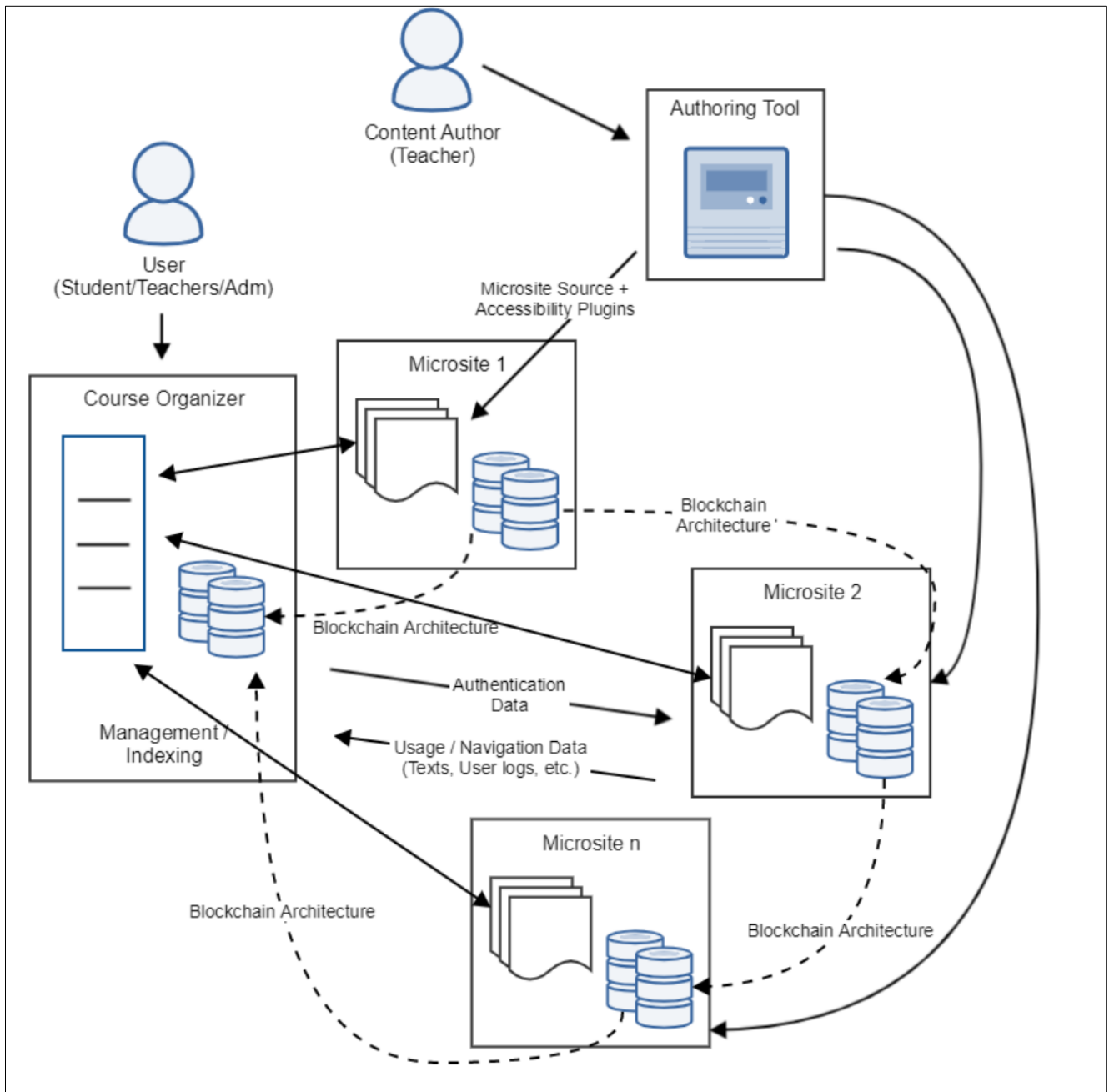

Figure 1 Blockchain ICT architecture

School authorities and principals should only hire teachers who are taught in inclusive education and require such training in teacher training centers. School authorities should introduce clear rules for punishing schools for refusing to admit students based on a disability that is inconsistent with the requirements of their schools.

Flexible curricula provide benefits for all students. Teachers should implement diversity management in the classroom and understand that each child has an individual approach to learning.

Teachers and supporters of children with complex support needs must be experienced and highly qualified to be able to develop and trust individual curricula and teaching methods. It is also important that they are given time and are engaged in the consideration of different curricula and teaching methods for different children [10].

Despite the ratification of the UN Convention on the Rights of Persons with Disabilities by almost all European countries, there are differences in the laws of different countries, and there are also peculiarities in the financing of this process.

Education for All (EFA), the Millennium Development Goals (MDGs), and SDG17 adopted by the United Nations (UN) have helped to focus investment on education. Nevertheless, today the implementation of international agreements is seriously complicated by the financial difficulties of several European countries that have arisen in connection with the flow of migrants overflowing Europe.

When organizing the education of children with disabilities, it should be borne in mind that even intellectually impaired students are at risk of constant or periodic learning difficulties, which makes it necessary to work systematically to prevent and/or overcome them.
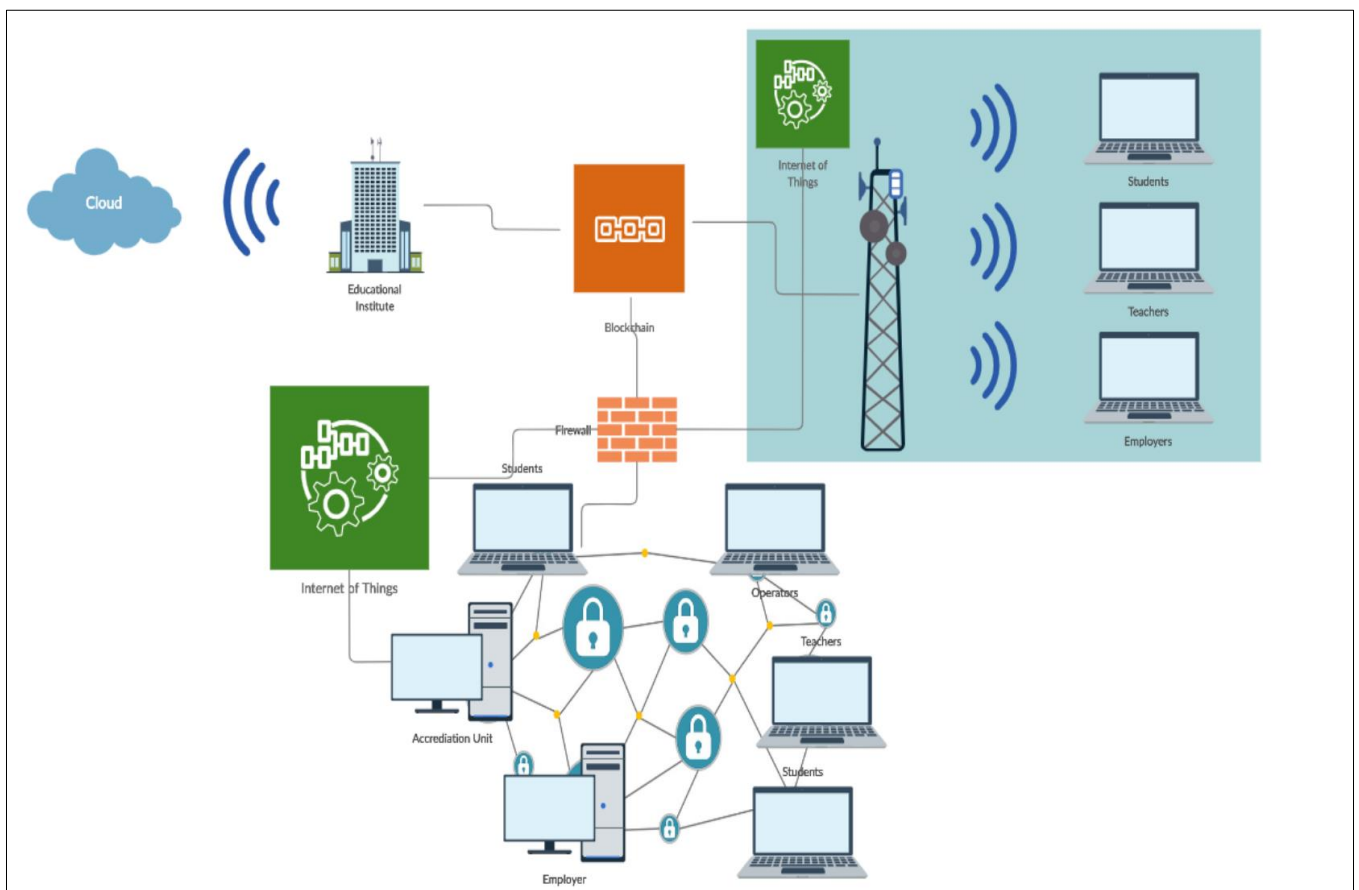

Figure 2 Blockchain framework form smart education

Learning difficulties of children with disabilities can be related to the lack of maturity of significant intellectual, verbal, sensory, and motor functions, emotional reactions, as well as a reduced level of brain activity.

Reduced level of brain activity caused by chronic illness and/or concomitant disorders of internal organ functions (endocrine, immune, cardiovascular, respiratory, excretory systems) is one of the leading causes of learning difficulties in children with disabilities. Abnormalities in these systems and chronic inflammatory processes lead to an insufficient supply of oxygen and exposure of the brain to toxic substances. Therefore, for many children with disabilities, the amount of academic work that is usual for other children is beyond their capabilities due to reduced mental performance due to neurological problems and/or due to internal organ disorders. This leads to instability of their performance, increased fatigue, problems of stability, concentration and switching of attention, and low volume of involuntary memory. It should be noted that such manifestations do not depend on the qualitative specificity of the structure of the defect, or the child's belonging to a certain clinical group. They are common to all children with disabilities [6].

Their consequence is the low speed of performance of tasks, inability to "grasp" a large volume of information at once, and mistakes for inattention. The explanation of the teacher is assimilated fragmentarily. Already after 10-15 minutes of a lesson, children with difficulty 111concentrating on the task, become lethargic or irritable and refuse to work ("I am not interested"). The increased motor activity of the child is compensation for the developing oxygen starvation of the brain; therefore, it is not recommended to slow it down, so that it does not increase the degree of fatigue.
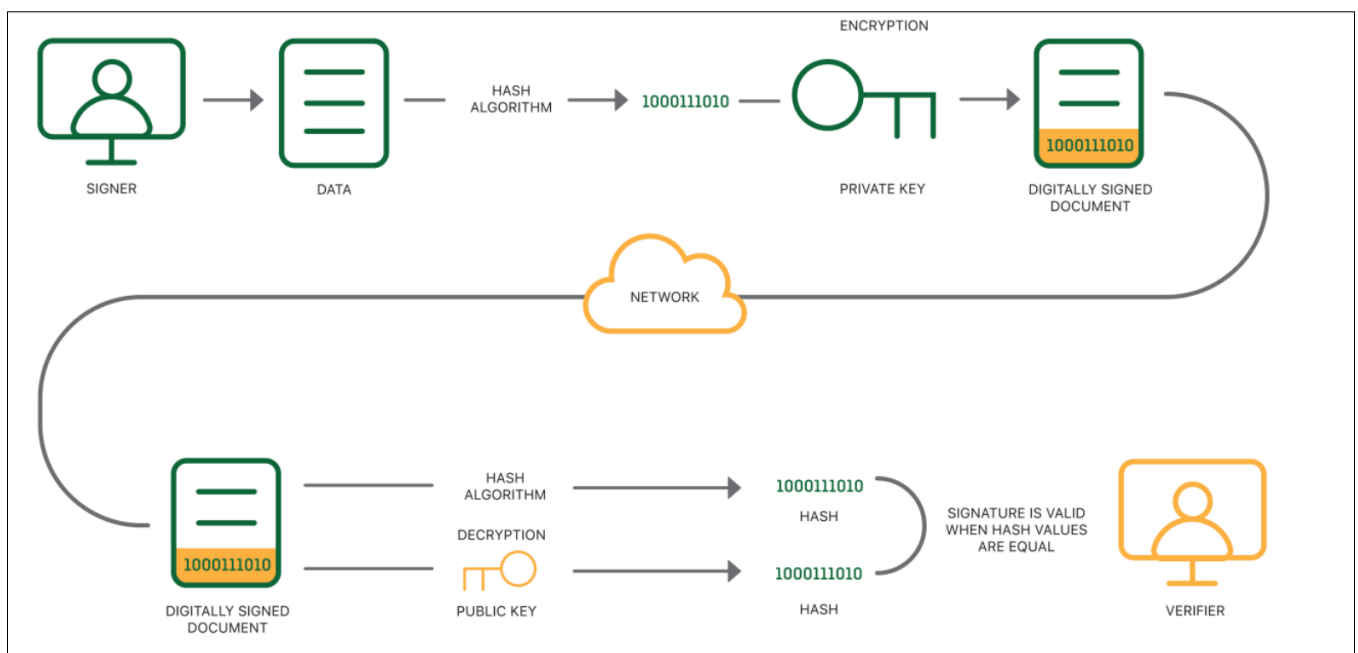

Figure 3 Anatomy of a Digitally Signed Document for smart education

Another significant reason for difficulties in learning for children with disabilities is the lack of maturity of their basic, sensor-motor mental processes and emotional sphere.

Perception is characterized by poor differentiation, slow pace and fragmentation, delayed formation of inter-analyzer connections, and connections between the perception of different modalities. Spatio-temporal orientations are insufficiently formed. Motor clumsiness and delays in the development of fine motor skills are often noted. Problems of switching from one movement to another, their joint performance, visual-motor, visual-auditory, auditory-motor, and other coordination often occur. These results in a range of difficulties in learning to write, read and do the math.

It is known that special corrective and developmental support is necessary to overcome the learning difficulties of children with disabilities in conditions of inclusion. However, it is not always considered that special help for children with disabilities can be effective only when combined with general educational approaches, focused on the health and development of the child. General and special approaches to overcoming the learning difficulties of children with disabilities are interrelated and, without duplicating, complement each other. Only in this unity can they be effective [8].

4. Discussion

The use of ICT makes the learning process more interesting and livelier [5]. Learning remotely, the child does not feel limited by spatial and temporal boundaries, he has a connection literally with the whole world. Thus, for children with disabilities, distance learning is a great opportunity to realize themselves. Distance learning has many advantages: access of children with disabilities to various resources; socialization and integration of children with disabilities into society; considering the individual characteristics of children; interactivity of learning; spatial and temporal infinity of learning; quality education of children with disabilities [8,9].

However, there are still some difficulties in distance learning. They are associated with high costs for the technical basis of education, pedagogical and methodological readiness of teachers, and technological readiness of participants in the educational process [12].

Thus, the use of ICT in inclusive education and distance learning for children with disabilities greatly facilitates the process of teaching educational material, has a beneficial effect on the intellectual and speech development of students with disabilities, develops the creative activity of children, and forms curiosity and increases interest in learning activities [1,6].

However, the author's analysis of the processes of introducing information technology into the system of inclusive education has shown that this activity cannot be considered satisfactory, since the existing informatization tools do not fully meet the needs of inclusive education. In particular, it has become known that existing curricula cannot always be mastered with the same level of success by children with and without disabilities; the existing curriculum interfaces poorly correlate with the needs and abilities of students with disabilities; some curricula (for example, those related to the physical development of students) are in principle not tailored to the needs of students with disabilities, which are known to discriminate against students with disabilities. These problems infringe on the fundamental rights of disabled people and require improvements in monitoring education to create an accessible, secure, and inclusive classroom environment, using blockchain technology to achieve this [3].

In recent years, blockchain technology has received increasing attention in the digitalization of inclusive education. Blockchain technology offers enormous opportunities for its effective use and has the potential to be 'embedded' in national education systems today [7].

4.1. Blockchain technology

- Pedagogical management processes, standardization of educational systems, activities related to information security and protection of learners' data (e.g. A learner can check at any time which body or entity of educational activity has accessed his/her electronic data, as any such access to personal data is documented and thus ensures transparency, security, and authenticity of the use of data concerning learners)
- Unified document management systems, and digital services of formation, use, storage, and/or control of information used in the educational sphere, which ensures trust in electronic data and documents; the problem of trust and security, confidentiality, and identification is solved;
- Blockchain infrastructure focused on academic research and publications, which allows automatically recording data on new publications in blockchain and storing a constantly updated picture of the links between publications (references, citations), which will solve the problems of stratification of academic publications by the impact factor of a particular publication, citation index, etc.
- Blockchain-enabled courses as well as massive open online courses are becoming increasingly popular as they provide practical knowledge about the state of inclusive education from anywhere in the world and have lower tuition costs. From the ability to combine individual courses to form separate blocks of courses, it is possible to synthesize different learning strategies for highly specialized fields, while blockchain allows the standardization of certificates and diplomas of universities and online education portals, legalizing them for all participants in the global learning space [10,11].

As a result, it has been concluded that blockchain technology is an indispensable tool for the development of a modern education system.

We believe that this technology can be indispensable for inclusive education as well.

It should be noted that the introduction of blockchain into the system for monitoring educational programs for the possibility of their use in the context of inclusion will allow:

- Reliable, online, determine the need for improving existing educational programs and developing new programs adapted for use in inclusion classes;
- Develop "curriculum passports" by the requirements for passing the program through the blockchain system;
- Monitor in real-time (smart contract algorithm) compliance with the formulated requirements at all stages of the implementation of the educational curriculum;
- Maintain a unified electronic document flow (reporting on the status of the educational process, passports of educational programs, reports on the health status and learning achievements of students in inclusive classes, etc.).

The basic scheme of using blockchain technology in the educational sphere could be as follows:

- The educational institution needs to send (receive) information that meets (must meet) the requirements of reliability, objectivity, completeness, etc.;
- Transactions (transfer of information) take place by placing information on the network, its receipt takes the form of a reference to the placed information. The information is received in a block, which has its number and hash of the previous block;
- The blocks are sent to all participants of the automated information exchange system;
- If the information corresponds to the requirements, each participant of the information exchange includes the "block" in its database;
- The such block is included in the blockchain, which contains information about all previous transactions;
- This information is delivered to the user, who can a priori consider this information to be valid and compliant with the requirements that have been formulated for this information basic scheme of using blockchain technology in the educational sphere could be as follows.

The use of blockchain in inclusion saves professionals time by allowing a digital profile of each child's development throughout their education. It protects personal information from unauthorized interference. It avoids the routine work of analyzing the dynamics of different aspects of a child's development, provides a holistic approach to the child and enables optimal solutions to biopsychosocial support for the child [2,13].

It would also be appropriate to use blockchain technology to create a system of "Monitoring of educational curriculum for the possibility of its use in inclusion classes". This would make it possible to

- Reliably identify online the need for improvement of existing education programs and the development of new programs adapted for use in inclusive classrooms;
- Develop "curriculum passports" by the requirements of the program's passage through the blockchain system;
- Monitor in real-time (smart contract algorithm) compliance with the requirements formulated at all stages of the implementation of the educational program;
- Maintain a unified electronic document flow (reporting on the state of the educational process, passports of educational programs, reports on the state of health and learning achievements of students in inclusion classes, etc.).

5. Conclusions

ICTs are widely used in inclusive education. However, there is little discussion about the use of blockchain technology. Its use in inclusive education seems appropriate in terms of the introduction of a unified electronic document flow, verification of educational curriculum for compliance with the requirements of inclusive education, preparation of passports of curricula and digital profiles of students, recording, and analysis of child development dynamics, ensuring the confidentiality of personal data and permanence of stored information

Compliance with ethical standards

Disclosure of conflict of interest

The author has no conflicts of interest in connection with the research topic, results and research tools with other authors.

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