

Analysis of learning methods in the digital educational environment

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Abstract. In this paper, modern ways of digitalization of the educational process are considered and analyzed. An alternative innovative solution can be a theory of inventive problem solving (TRIZ) - a methodology, taking into account the didactic principles of education (continuity, succession, accessibility, etc.). The dynamics of innovative technologies requires constant updating of the educational environment; inclusion of the teacher in the educational activities; active forms of learning (integrated classes, search and research activities); free access to digital repositories (methodological and lecture materials); social networks (Internet communities of teachers, teachers). The introduction of new information and communication technologies (ICT) in the management of the educational system made it possible to achieve a number of goals: modernization in the transfer/acquisition of knowledge (online/distance learning); application of a creative approach in pedagogical activity; the use of methodological and didactic forms of education (personalized learning, meta digital complexes, digital technologies).

1 Introduction

The education strategy in Russia determines the quality of the educational process at all levels of its implementation, taking into account the continuity, coordinated, and promising interaction of all components of the system (goals and objectives, methods, and means). According to the results of 2020, Russia entered the top 10 countries in terms of general education [1].

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The digitalization of education is seen as an inevitable process of transforming the content, methods and organizational forms of educational work, unfolding in a rapidly developing digital educational environment and aimed at achieving the goals of the country's socio-economic development in the context of the fourth industrial revolution and the formation of a digital economy [2].

In the context of digitalization, it is easier to put into practice a personalized approach to students, taking into account the needs and characteristics of the individual, including children with special needs. The digital environment can create equal opportunities for everyone [3].

The possibilities of digital technologies are rapidly developing and there is an increasing amount of people who own a variety of technologies. But there are questions not only to the development and application of new tools but also to their pedagogical competent use in the educational process [4].

Digitalization of the educational process, in the new conditions, helps the teacher not only plan but also more effectively carry out pedagogical activities. The main features of the new digital Russian school, which should be created by 2025, will be its innovativeness and versatility, which will make the learning process of Russian schoolchildren much more convenient and efficient for both the students themselves and teachers [5].

For successful digitalization, it is not sufficient to transfer educational materials into electronic form - digitization. The use of new information and communication technologies is only a scientific condition for the further development of digital pedagogy, the evaluation criterion of which will be its usefulness for students [6, 7].

The TRIZ method created by the Soviet engineer and writer G. S. Altshuller has successfully proven itself. The author noted: For the formation of an active creative position, at least six qualities are needed [8]:

- The presence of a worthy goal - a new (or unachieved), significant, socially useful.
- Ability to program the achievement of the goal.
- Great working capacity for the implementation of the plans.
- The ability to solve creative problems in the chosen area, possession of the technique of overcoming contradictions on the way to the goal.
- Willingness to "take a hit": defend your ideas, endure non-recognition, misunderstanding.
- Efficiency: on the way to the final goal, intermediate results should be generated regularly.

The International TRIZ Association includes more than 30 countries. The versatility of this technique is applicable in many areas of science, technology, art, and business. With the help of TRIZ, new solutions are found in such innovative corporations as General Electric, Samsung, Siemens, Boeing, Ford, Daimler Chrysler, Hewlett Packard, Kodak, Procter & Gamble.

The relevance of the digitalization of education is currently associated with the needs of the digital economy in personnel prepared for activities within the framework of its ideology and technologies. The labor market needs specialists with a wide range of competencies. New information technologies in education are necessary for working in a digital economy [9-13].

2 Research methodology

In the process of digitalization, the very structure of education and the organization of the educational process is fundamentally changing. These changes will require both the choice of material for the creation of courses and their organization, as well as the management of an educational institution [14].

An integral component of this process will be the diagnostics of learning outcomes. Compiling a database helps in tracking the progress of the child, to see the gaps, to help him, and as a result, to increase the level of knowledge. Information about each student will make

it possible to predict and determine directions for further development. The creation of a unified electronic database of educational institutions of the country increases the availability and openness of the education sector. Studies have shown that education in the digital age is undergoing global changes, which radically affects the subject area of pedagogy. The basic ideas of education, at their core, must not be lost.

Before digitalization, there was a cognitive approach (the concept of "to know"), the student was a "consumer of knowledge", and the content of education was "delivered" in a finished form. Now the student is brought up as a "creator". The assimilation of information using digital technologies helps to generalize, systematize, generate the acquired knowledge, develop critical thinking. The main result of digital transformation is the development of the personal potential of the student at all levels of education.

In the infosphere, the communication and information resources of the personality of students are expanding, helping to successfully master the social environment. Students create a modern reality of relations in the information space, while simultaneously acting as the subject and object of the created virtual reality [15].

Scientific understanding of the phenomenon of continuity in the context of the methodology and theory of pedagogy allows not only to understand the essence of modern trends in the development of education and the possibility of its social regulation (including in the aspect of professional and pedagogical training), but also to determine methodological approaches to the problem of scientific and methodological (resource) ensuring the modern educational process as a result of the operationalization of modern socio-humanitarian approaches to education [16].

With the correct organization of the educational process, the use of computer tools increases the ability of the teacher and student to achieve their goals, taking into account the individual needs and characteristics of each user of the system, thereby:

- increases the interest of students in the subject being studied (educational simulators);
- the ability to choose the optimal pace, volume when studying the material or repeating the previously studied (managing the change of texts, slides);
- the subject-game environment makes the lesson interesting, rich (use of animation, illustration, feedback);
- education of perseverance and concentration of attention (multi-level didactic games);
- the ability to organize independent work on the assimilation of general educational disciplines (the development of subject, meta-subject, and interdisciplinary disciplines);
- facilitates verification of acquired, mastered, and residual knowledge;
- feedback (when consolidating the material, the student can correct mistakes and improve their results).

Combining traditional learning materials with an intelligent learning system allows extensive use of formative assessment and relevant problem-based learning work. This contributes to the development of mathematical thinking in a student-oriented educational environment [17, 18].

In maintaining the continuity between pre-school - primary school - basic general education, general relationships are considered: identification of problem points; ways out of these problems; a combination of psychological, pedagogical, physiological knowledge; finding solutions to overcome these difficulties; introduction of perfect methods and teaching aids into the educational process.

The continuity between preschool education and the schooling of children has always been one of the most important pedagogical problems. "The school should not make an abrupt change in the lives of children. Let the child, having become a disciple, continue to do today what he did yesterday. Let the new appear in his life gradually and not overwhelm with an avalanche of impressions", this is how V. A. Sukhomlinsky [19] represented the continuity between preschool and school-age.

The uniqueness of didactic opportunities with the use of ICT tools brought novelty and expanded the boundaries in the development of educational material:

- Implementation of an online dialogue, active interaction between a teacher and a student is practiced through the system.
- Visualization of educational information on the studied discipline, process, object.
- Computer simulation of real and virtual processes.

ICT has the following didactic capabilities:

- the capability of prompt transmission over any distance of information of any volume, any form of presentation;
- the capability of storing this information in the computer memory for the required duration of time, the possibility of editing, processing, printing, etc.;
- the capability to access various sources of information, including remote and distributed databases, numerous conferences around the world via the Internet, work with this information;
- the capability of organizing electronic conferences, including in real-time, computer audio conferences, and video conferences; Possibility of dialogue with any partner;
- the capability to transfer the received materials to your media, print, and work with them when and how it is most convenient for the user.

A means of developing the qualities of a creative personality can be realized through TRIZ technologies based on traditional didactic principles of learning (accessibility and feasibility, consciousness, visibility, systematic, scientific, active, differentiated, and individual approach), and digital content makes the educational process more intense and exciting. One of the main means of consolidation and control in the technology under consideration is didactic material (didactic games), in relation to the conditions of the digital environment. TRIZ is based on the objective laws of scientific, technical, artistic, and creative development.

The didactic game makes it possible to solve various pedagogical tasks in a playful way, the most accessible for preschoolers. The value of didactic materials lies in the fact that they are created for educational purposes. Thanks to their use, it is possible to achieve stronger and more conscious knowledge, skills, and abilities, and didactic game awakens children's imagination, creates high spirits, is aimed at solving specific problems of teaching children, but at the same time, it shows the educational and developmental influence of game activity [20, 21].

D. B. Elkonin writes: "The central point of the didactic game is the contradiction between game motives and non-game ways of activity. As a result, the entire activity as a whole undergoes changes. What served only as a condition of play and a secondary element of activity acquires a more substantial meaning for the child, more and more independent of play" [22].

The previously reviewed continuity of preschool-school education with the modern trend of the times (digitalization – game), is a fundamental aspect to the practical application of gaming technologies in pedagogical practice. The inclusion of gaming technologies in the organization of the learning process has a positive effect on the result of educational work [23].

3 Results and discussion

In the era of global changes, it is very important to ensure the transition from one level of consideration of the theoretical problems of teacher education of the historically established methodology to the development and implementation in the process of such activities that ensured the satisfaction of the needs of all subjects included in this process. IR technologies, 5D printers, the Internet have turned the whole generation's ideas about life upside down.

The modeling of methodological support from the traditional approach to the prefigurative one is undergoing tremendous changes.

The involvement of children in the dynamics of social change, their acquisition of the role of creators testifies that in modern society, prefiguration manifests itself, and the change itself is at the turn of eras [24, 25].

Interactive learning simultaneously solves three main tasks: educational or cognitive, communicative and developmental and socially oriented. Learning is considered as an intensive, multifaceted, interpersonal communication of all subjects involved in the cognitive process. For the teacher, computer technologies provide an opportunity to 'activate' the student, organize self-control, and realize the individual pace of learning [26].

Mastering digital technologies by schoolchildren creates new opportunities for the implementation of the educational process. The child as an active subject of educational activity develops intellectual abilities; forms personal, subject and meta-subject competencies.

In the context of digitalization, the spread of telecommunications and network technologies and teaching aids, the content of the subject of didactics is expanding significantly by the following factors [27, 28]:

- by learning limited to the classroom process - to learning in various environments and spaces, including network and virtual;
- by the educational process of an educational organization to learning in the educational network and self-learning in the educational environment;
- from organizing the activities of teaching and learning to organize the processes of designing, forming by mastering educational routes;
- by teaching as the leading activity of a teacher to the diversity of pedagogical functions of a teacher in the digital educational process.

The basic provision of TRIZ says: "Systems develop according to certain laws that can be identified and used to consciously solve inventive problems, without random wandering and meaningless trials." Achieving a creative level of personality development can be considered the highest result in any pedagogical technology. But there are technologies in which the development of creative abilities is a priority goal, these are:

- identification and development of creative abilities (by Volkov I.P.);
- technology of education of social creativity (by Ivanov I.P.)

Of the main goals of school education (educational, cognitive, and developmental), TRIZ technology brilliantly fulfills the developmental one. A developed intellect will decide the cognitive goal itself. As for the educational goal of pedagogy, creativity has a great potential for morality, and the culture of the mind educates the general moral culture of a person, determining his active life position [29].

The advantages of using gaming forms of learning in the classroom are that gaming activity as a means of learning is motivated for learning, lack of coercion, individualization, training, and education in a team and through a team, development of mental functions and abilities, learning with passion. Game activity affects the development of attention, memory, thinking, imagination, all cognitive processes. So, for example, the pedagogical and didactic value of a business game is that it allows its participants to reveal themselves, learn to take an active position, test themselves for professional suitability [30, 31].

Pedagogical approbation of certain practices in their applicability should ensure the success of mastering the curriculum by each student: revealing one's own potential (ability to make non-standard decisions; manifestation of initiative; development of creative thinking). Digital educational resources must meet the methodological requirements:

- variety work types (individually, in groups);
- motivational component;
- implementation of training in cooperation;

- feedback implementation;
- humanization (taking into account age characteristics and differences in cultural experience);
- purposefulness (achievement of goals);
- reliability of the information;
- pedagogical flexibility;
- the possibility of returning (erroneously performed actions);
- validity and objectivity of assessment.

Obtaining the expected results is possible with the effective use of all components of digital educational environments; software environment (software and telecommunications environment), subject environment (specific area of knowledge), technical environment (security base for the implementation of the main tasks), methodological environment (order of use).

4 Conclusion

The main commodity of the information age is knowledge, and the function of education is to teach a person to live in a rapidly changing world. Formation of a unified digital educational content - obtaining a better education. The optimization of this process is characterized by the accumulation, processing, storage of information and its use by electronic means.

The use of ICT is associated with the expansion of new forms of organization of the educational process based on the principle of independent learning of students; the possibilities of solving specific educational problems and managing the process of their solution are expanding. The versatility of computer technologies makes it possible to select and implement an individual trajectory of students in an open educational space: an electronic diary, the zune program, Google, social networks, blogs.

Three methodological approaches can be considered as a holistic methodological basis of the digital educational process. First, there are stable relationships between these approaches: the results of the implementation of each of them determine the results of the implementation of the other two. Secondly, the implementation of these approaches relies on the logical framework of activities as an essential component of the methodology. And, thirdly, all these approaches, jointly implemented, provide a reliable learning outcome in a digital educational environment [32].

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