

# COMPUTER TECHNOLOGIES INFLUENCE ON THE DEVELOPMENT OF PRESCHOOLERS' COGNITIVE ACTIVITY

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## Abstract:

The article proves that computer technologies are a modern effective means of forming the cognitive activity of preschool children. It is specified that teachers need to distinguish between cognitive agency and cognitive activities, the development of which is directed by the influence of computer technologies. It is substantiated that by stimulating cognitive activity with computer programs, a child gains experience of cognitive agency. It is noted that regarding the content of the concept of activity, cognitive, it is necessary to consider the dynamism and processual of this phenomenon in the interrelationships between its components of implementation: motives, goals and objectives, actions, and operations, means of implementing methods of activity, mechanism of reflection (self-control and self-testing), etc. In general, activity, in contrast to agency, is a more complex psychological formation of a child's personality. It has been determined that the development of cognitive agency by means of computer technologies is

facilitated by the fact that in each of the educational areas the child learns and studies something new: an aspect, a problem, a way of solving it, new practical or thinking actions. In such a dynamic process, children's cognitive agency rises to a qualitatively higher level, transforming from a situational to a more stable type. The computer-oriented educational environment of preschool education institution is characterized.

**Keywords:** cognitive activity, cognitive agency, preschool children, computer technologies, online services, computer games.

## INTRODUCTION

The use of computer devices is becoming increasingly common in the modern world among preschool children. The growing availability of smartphones, tablets, computers and other gadgets leads to an increase in screen time among children aged 4-7. One of the main factors behind the spread of computer technologies in the lives of preschoolers is their widespread use in the educational process. Preschool teachers use computers and tablets as part of the learning process, offering children presentations, educational programmes, games and interactive exercises. In addition, parents of preschoolers use electronic devices to entertain and occupy their children to avoid their capriciousness, capriciousness, and easy supervision. Cartoons, video games, music and educational programmes help to develop various skills and abilities, and, unfortunately, can also act as a distraction for children. However, it is important to understand the impact that a large amount of screen time can have on children's development. On the one hand, computers and smartphones provide access to information and educational resources that can stimulate the development of a child's cognitive activity. On the other hand, excessive gadget use can have negative consequences for the emotional, volitional and social development of preschoolers. That is why it is necessary to identify the possibilities of computer technologies and programmes for the effective intellectual development of children, their socialisation and education.

## COGNITIVE AGENCY AND ACTIVITIES OF PRESCHOOLERS

It is necessary to understand the difference between agency and activity of preschool children, in particular the psychological side of their formation by means of computer technologies. In scientific speech, it was not possible

to avoid confusion of these concepts, so both activity and agency are denoted by the lexeme activity. This problem is solved by the philosophical approach. Researchers Etienne Balibar and Sandra Logier note that the concept of “activity” should be denoted by the term agency, because it is not yet activity, but rather a state of readiness for activity, but at the level of its individual components: whether it is only goal setting, or the choice of means of cognition, or the process of reflection or correction of actions<sup>1</sup> [European Philosopher]. By stimulating cognitive agency, influencing its development, by working with computer programs, a child acquires experience of cognitive agency, and subsequently can independently influence the development of individual components of activity. Regarding the content of the concept of activity, in particular cognitive activity, it is necessary to consider the dynamism and procedural nature of this phenomenon in the interrelationships between its components of implementation, which have a sequential nature of implementation: motives, goals and objectives, actions and operations, means of implementing methods of activity, reflection mechanism (self-control and self-testing), etc. This leads to the thesis that activity, in contrast to agency, is a more complex psychological formation of a child's personality. What is common to cognitive agency and activity is that computer technologies can be an effective means of forming both.

The content of preschool education is aimed at mastering children's competencies, namely: motor and health, personal, subject-practical and technological, sensory and cognitive, logical-mathematical and research, natural and environmental, and skills focused on sustainable development, game, social and civic, speech, artistic and speech, artistic and creative (artistic and productive, musical, theatrical) and others<sup>2</sup> [BCPE]. The development of each of the competences reveals the educational potential of the use of computer technologies. The formation of cognitive agency by means of computer technologies is facilitated by the fact that in each of the educational areas in the educational process, the child learns and studies something new: an aspect, a problem, a way of solving it, new practical or thinking actions. In such a dynamic process, children's cognitive agency rises to a qualitatively higher level, transforming from a situational to a more sustainable type. In addition, it is important to realise that cognitive agency because of preschool education is manifested in the preschooler's readiness for systematic schooling, it becomes

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1 CASSIN, B. (eds.). (2011). *Yevropeyskyi slovnyk filosofii: Leksykon neperekladnostei* [European dictionary of philosophies: A lexicon of untranslatability]. Kyiv: Dukh i litera. [in Ukrainian]

2 The State standard of preschool education of Ukraine. 2021. URL: [https://mon.gov.ua/storage/app/media/rizne/2021/12.01/Pro\\_novu\\_redaktsiyu%20Bazovoho%20komponenta%20doshkilnoyi%20osvity.pdf](https://mon.gov.ua/storage/app/media/rizne/2021/12.01/Pro_novu_redaktsiyu%20Bazovoho%20komponenta%20doshkilnoyi%20osvity.pdf)

a basic quality of the child's personality. Without a proper level of preschoolers' cognitive agency, it is impossible to assert that a child is successfully ready for school, that he or she is a successful person in primary school, and that he or she has mastered learning activities.

## COMPUTER TECHNOLOGIES IN PRESCHOOL EDUCATION

We agree with the opinion of O. Gotko and O. Tchaikovska that 'the introduction of ICTs in modern education significantly accelerates the transfer of knowledge and the accumulated technological and social experience of mankind not only from generation to generation, but also from one person to another'<sup>3</sup>. A wide range of computer technologies, programmes and gadgets is an indicator of the development of the modern information society. However, not all of them meet the age-related psychological characteristics of preschool children, the process of children's cognition of the environment, the requirements and capabilities of the educational process, the capacity of preschool education institutions and parents. In view of this, it is necessary to determine the criteria for selecting computer technologies that will contribute to the most effective formation of children's cognitive agency. According to the defined criteria or features, computer technologies should be arranged and grouped for the convenience of the pedagogical process. Let us consider several approaches to grouping computer technologies that ensure the efficiency and quality of the educational process.

The first group of computer technologies, in our opinion, is those that ensure the organisation of a holistic educational process without interrupting its course. Such computer technologies relate primarily to the organisational and managerial level of preschool education (Google Workspace, Microsoft Office 365 products, etc.). They are caused primarily by modern global challenges and dangers that make it directly impossible to visit preschool education institutions, to communicate with the staff and administration of the institution with the children's families, to access documents and work plans, etc. In recent decades, such dangers have included wars, pandemics, earthquakes, floods and other natural disasters.

The second group of computer technologies includes those that provide a stable, continuous connection between the educator and the group of children and

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3 HOTKO, O. and CHAIKOVSKA, O. (2015) Informatsiino-komunikatsiini tekhnolohii yak suchasnyi zasib navchannia v osviti [Information and communication technologies as a modern learning tool in education]. *Molod i rynok – Youth and the market*, 4, 130-134. [in Ukrainian].

ensure the integrity of learning and play activities. The technologies, programmes and applications belonging to this group are designed to provide different types of connection and communication: online, offline, combined, synchronous, asynchronous, etc. Here it is important to select those computer technologies that integrate as many capabilities as possible and do not require searching for or engaging additional ones. For example, video communication software (Zoom, Google Meet) is effectively combined with the ability to record broadcasts, save chat conversations, demonstrate screens, presentations, spontaneous writing on a virtual whiteboard, the ability to divide children into teams for group work, etc. This approach is determined by the specifics of preschool age: children are not yet able to self-organise their cognitive activity and learning activities, their attention is unstable, and their imagination, thinking and memory are involuntary, and besides, children quickly get tired of the monotony of events and monotony of speech, etc. All this must be considered when organising the educational process. Such complex computer technologies are the basis for maintaining emotional connection, communication, and children's learning activity, so it is necessary to take care of instructions, memos, and directions so that children learn the necessary buttons and navigation as quickly as possible.

In addition, the technologies of the second group relate to the implementation of not a particular educational area of preschool education or lesson, but all of them in general. That is, based on a specific video communication programme, a teacher can organise two or three online classes with children in one day. That is why it is so important to spend time mastering the most basic skills of using this programme. This should include those applications and technologies that the educator uses on a regular basis: creating presentations, videos, instructions, services for creating educational games and exercises. The teacher uses them constantly, systematically and selects the most convenient ones.

The third group of computer technologies in preschool education is represented by elementary ones, or those with a single purpose and a single use. They are rarely used by teachers and children, but for educational purposes. These are the most common computer technologies. For example, services for creating puzzles, graphic riddles, didactic games, quizzes, online puzzles, virtual maps. Performing cognitive activities with the help of these services, respectively, contribute to the development of children's cognitive interests, motivate them to work independently for a longer period, develop attention, curiosity, and initiative. The use of technologies of this group diversifies the educational process and children's learning activities, stimulates cognitive agency in mastering new ways of practical and mental activity.

## COMPUTER TECHNOLOGIES FOR THE FORMATION OF COGNITIVE AGENCY OF PRESCHOOLERS

Computer technologies for the formation of cognitive agency at the level of individual training sessions, exercises and tasks should be considered according to the direction of implementation of educational areas of preschool and primary education<sup>4</sup>. For example, in the educational area of 'Child's Speech', speech and cognitive agency is formed, around 'Child in Sensory and Cognitive Space' - sensory and cognitive, in 'Child's Play' - cognitive and game activity, etc. Thus, the types of cognitive agency of preschoolers are closely related to the types of children's activities and are aimed at mastering specific competencies in each of the educational areas.

For the development of speech and cognitive agency, one of the most important means is the teacher's personal speech in joint activities (communication) with the child. To develop its high level, various computer technologies can be used, including video communication programmes for the development of coherent monologue and dialogue speech, videos and cartoons for the development of phonemic awareness, speech and didactic online games for articulation apparatus training and the development of sound culture of speech ('Mouse Alphabet', 'Ukrainian Alphabet for Children', 'Learning Words from Doman Cards', 'Whynashki'). When organising online classes, teachers should remember that computer transmission of sound and human voice is somewhat different from the natural sound of timbre. This means that it is necessary to provide for the availability of high-quality sound, if the lesson takes place in a preschool education institution, and a microphone and headphones for online lessons. It is common practice to use audio recordings of speech, for the purpose of developing foreign language communication activity. It is important to remember that the sound system of each language differs in the way and place of sound production, so it is worth using professionally made and well-processed audio recordings of speech, songs, poems, etc. The same applies to the use of cartoons in the educational process. Often, cartoons are voiced by children in unlikely voices, which distorts auditory perception and contributes to unnatural speech sounds. That is why we propose to use recordings of real people and children from the experience of kindergartens and families of children with their consent (NUMO-Kindergarten Online, Kazky Suspilne).

Teachers develop sensory and cognitive agency and logical and mathematical

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4 SARIENKO, V. (2017). Kompiuterni tekhnolohii yak zasib aktyvizatsii piznavalnoi diialnosti uchniv pochatkovoi shkoly u navchalnii diialnosti [Computer technologies as a means of stimulating the cognitive activity of primary school pupils in learning]. *Molod i rynok – Youth and the market*, 1, 78-82. [in Ukrainian].

competence using online services for creating games and exercises. Such games provide an opportunity for a child to work 'one-on-one' with a computer and educational material hidden behind the game plot. Preschoolers abstract themselves from everything around them, focus their attention on the computer screen, become fully involved in all the events unfolding during the computer game, think algorithmically: what action should be performed first, what action should be performed next - in accordance with the conditions and rules of the game. The synthesis of a didactic mathematical game and a computer game provides a type of these games in which the teacher's leading role is hidden, as if the preschooler is 'offered' to play a game by the computer itself, and learning will take place unnoticed by the child. Using the game format as the main method of developing logic and thinking is very effective. In such online mathematical games, preschoolers learn the concepts of sensory standards (colour, shape, size, value), plane and three-dimensional geometric shapes, number and quantity, compare sets of elements, learn mathematical signs and laws (addition, reduction, division, equality), master the basics of arithmetic ('Numbers for Children: Children's Game', 'Shapes. Games for Kids', "Kids Numbers and Math"). Sensory and cognitive games are favourable for the development of thinking operations, including classification, analysis, synthesis, seriation, generalisation and comparison, etc.

Cognitive and natural agency is formed in children's experimentation, observations of nature, elementary work in the natural environment, excursions to nature, research activities. Acquaintance with the natural environment in preschool education involves a significant number of concepts and phenomena that are extremely long in time, and children cannot perceive and understand them extremely quickly. Such concepts, processes and phenomena include seasonal changes in nature in the lives of people, animals and plants, the life cycle of organisms, the change of seasons, time of day, changes in the position of the Sun, weather phenomena, elementary knowledge of the Universe, its elements, including stars, planets, meteorites and other bodies. To this end, educators often use computer programs that allow them to reproduce these processes and phenomena in an accelerated format. One of these is the Mozaik Education service. When studying the topic 'Planets of the Solar System', preschoolers could perform various manipulations with objects presented in the 3D scene environment: change the viewing angle of the solar system, increase and decrease its size, move it away, choose different options for displaying information. For example, preschoolers can view the Earth in cross-section, the planet's orbit, the Moon, etc. This service also has an 'Animations' mode, which includes sound and is best suited for explaining new educational material.



One of the modern means of developing cognitive and gaming agency of preschoolers is computer games, online (Optima school, Ma Panda). The entertaining format helps children learn new educational material more effectively. In fact, it is the game that is a natural way to acquire new knowledge, skills and abilities in preschool childhood. The game process develops children's hypothetical thinking, which is essential in adult life<sup>5</sup>. Learning through play allows you to combine theory with practice, so new knowledge for the future becomes necessary right now, at the moment of play. The simplicity and accessibility of character control in a computer game enables children to work independently with an online game; funny animated characters and a motivation system arouse cognitive interest, and soundtrack helps to memorise new material faster and better. However, when using online games to develop gaming competence, teachers need to keep in mind both the advantages and disadvantages of online computer games, even for educational purposes. On the one hand, computer-based educational games provide an opportunity for the player to show ingenuity, develop creativity, memory, and attention; train reaction speed; help increase the level of visual perception of information, teach the child to make decisions and experiment, and develop technical skills in working with computers. On the other hand, computer games, in particular educational games, are characterised by: harm from prolonged sitting in one position, eye strain when looking at small, overly detailed pictures, the effect of aggressive colours on the psyche, excessively fast, inappropriate for the age of children, prolonged time in front of the screen, the formation of incorrect ideas about the world around us, the development of addiction to games, etc. When creating their own or using a ready-made educational computer game for children, educators should keep in mind both the positive and negative effects of this type of computer technology.

The use of computer technologies promotes the development of artistic and cognitive agency, artistic and creative activity, in the process of which children's imagination, fantasy, and desire to create develop. Children have a need to express their impressions and emotions from learning about the environment in words, drawings, sculpture, movement, and singing. Children sincerely and directly express their thoughts, express their experience in various types of productive activities, creating new images. That is why an artistic and educational project with the creation of a virtual art book can be organised in the educational process of preschool education. Computer technology, such as Book Creator, will also help with this. The service allows you not only to create an e-book, but also to reproduce an existing one. The list of such books can be organised into thematic

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5 ZHUK, YU. O. (ed.) (2012). *Orhanizatsiia navchalnoi diialnosti u kompiuterno oriietovanomu navchalnomu seredovyshchi* [Organization of learning activities in a computer-oriented learning environment]. Kyiv: Pedahohichna dumka. [in Ukrainian].



collections, which is convenient for searching and revisiting. Such computer technologies also often provide the ability to voice each page of the book, which makes it possible to integrate different types of art: recitation of prose and poetry, theatrical activities and dramatisation, retelling fragments of works, acting out dialogues and events by roles, etc. The creation of virtual art books helps to engage the whole group of children, strengthen friendships between them, develop interpersonal communication, etc. For example, the pages can be children's digitised drawings on a given topic or plot. A teacher can create a separate art book from photos of children's memories of an excursion, trip or hike, as well as images or photos of new objects and phenomena that preschoolers have learned. Such collective projects with the help of computer technology contribute to a higher level of interest in the arts, visual and spatial arts, and create a desire in children to learn new objects and phenomena.

The impact of computer technologies on the development of preschoolers' personal and cognitive agency is also positive in the educational process. In this direction, it is important to direct the use of computer programmes towards mastering personal, health and socio-emotional competence. For example, when studying the human digestive system, you can visualise inaccessible organ systems and blood vessels using the AR\_Book online application. Working with this application, the educator facilitates the perception of the digestive system, as it is presented in 3D. It is possible to simultaneously accompany the review of the system with a parallel voiceover about their functions and features. The interface allows you to listen to the information again, as well as use the camera to, for example, project organs onto a real person. The Erudito app also helps to build motivation for cognitive agency and increase cognitive interest by offering a motivation system through the accumulation of rewards for completed tasks and completed levels. Preschoolers receive coins for solving each task if they win an 'online battle' and compete in knowledge with other users. The reward system also includes experience points, which affect the overall user rating.

Another example of personal and cognitive development with the help of computer technology is programmes that help preschoolers learn to record the main manifestations of their mood (thoughts, feelings, emotions, states, etc.) and understand their interconnection through cognitive activity. This was facilitated by writing in emotional diaries, such as Mood Diary, EMMO, Mental Health: My Mood' and others. The ability to record one's mood forms the ability to be aware of one's own mental acts and states. Preschoolers learn to be aware of the effectiveness and efficiency of their own cognitive activity, the reasons for its success and failure by choosing appropriate emotional images in the form of emoticons and icons. The programme allows you to track the dynamics of mood

changes over the course of a week or a month. Thus, the preschooler's ideas about the cognitive development of his/her personality are formed.

## CONCLUSIONS

Thus, computer technologies can be a successful means of developing the cognitive agency of preschool children. They have a positive impact on the overall development of the child if the educator is aware of which computer services and programmes are necessary for a particular type of cognitive agency: speech and cognitive, personal and cognitive, cognitive and game, natural and artistic cognitive. For the convenience of pedagogical use and optimisation of the educator's activity, the technologies are grouped into three groups: computer technologies of the organisational and managerial level, which ensure the integrity and continuity of the educational process and the activities of the preschool education institution; computer technologies of the educational and methodological level, which ensure constant communication between the educator and a group of children, organise cognitive activities for training sessions, games; computer technologies of the elementary level, which are used and changed in the preschool education institution. For each type of cognitive agency, the educator can choose a system of computer technologies that will contribute to the qualitative formation of preschoolers' competences.

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