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PEDAGOGICAL CONDITIONS FOR THE FORMATION OF INFORMATION AND DIGITAL COMPETENCE IN YOUNGER SCHOOL STUDENTS AT COMPUTER SCIENCE LESSONS

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The article presents the theoretical justification of the pedagogical conditions for the formation of information and digital competence in younger school students at Computer science classes. In the research process, certain pedagogical conditions were identified and systematized, which must be observed for the effective formation of information and digital competence in younger schoolchildren, namely: stepwise formation of information and digital competence; systematic digitization of the computer science education process; proper motivational provision of the educational process.

***Keywords:** pedagogical conditions; information and digital competence; younger schoolchildren; informatics; information technologies; educational activity; information; information culture; computer.*

ПЕДАГОГІЧНІ УМОВИ ФОРМУВАННЯ ІНФОРМАЦІЙНО-ЦИФРОВОЇ КОМПЕТЕНТНОСТІ В МОЛОДШИХ ШКОЛЯРІВ НА УРОКАХ ІНФОРМАТИКИ

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У статті представлено теоретичне обґрунтування педагогічних умов формування інформаційно-цифрової компетентності в молодших школярів на уроках інформатики. Метою формування інформаційно-цифрової компетентності учнів початкових класів є розвиток здатності школярів орієнтуватися в інформаційних потоках, визначати в них головне і необхідне, усвідомлювати потребу в достовірній інформації, вміння формулювати питання, визначати джерела інформації й використовувати успішні стратегії її пошуку, вміння самостійно шукати, отримувати, систематизувати, аналізувати та відбирати необхідну для вирішення навчальних завдань інформацію, а також творчо опрацьовувати, зберігати та передавати її; вміння використовувати програмні засоби, орієнтовані на вирішення завдань у різних сферах діяльності. В процесі дослідження виявлено та систематизовано певні педагогічні умови, яких необхідно дотримуватись для ефективного формування інформаційно-цифрової компетентності в молодших школярів, а саме: поетапність формування інформаційно-цифрової компетентності; систематична цифровізація процесу навчання інформатики; належне мотиваційне забезпечення освітнього процесу. Все це здійснюється в умовах інформаційного середовища яке, повністю розкриває зміст переданої навчальної інформації, закладає уявлення про основні способи діяльності, пов'язаних із засвоєнням форм і прийомів роботи з різноманітною інформацією, що сприяє формуванню інформаційної культури школяра підвищенню інтересу до способів раціонального набуття і опрацювання інформації та розвитку умінь загально-навчального характеру.

Ключові слова: педагогічні умови; інформаційно-цифрова компетентність; молодші школярі; інформатика; інформаційні технології; освітня діяльність; інформація; інформаційна культура; комп'ютер.

At the current stage, a low level of information culture of schoolchildren is observed, because they do not recognize their own incompetence in the field of information activities; do not realize the value of special knowledge and skills of information self-service; they do not understand what real help these knowledge and skills can provide them in various spheres of practical activity – educational, research, self-education, leisure. After all, to be well-informed in the world of information is to be informationally competent. The stated problem is actualized in the conditions of primary school activities, since it is here that basic competences are established as a necessary condition for fully mastering the content of education, forming the desire and ability to learn.

The problem of forming the informational and digital competence of an individual has always attracted the attention of psychologists, pedagogues, methodologists, and practicing teachers. Therefore, modern pedagogy already has certain developments in this direction. Some problems of formation of information and digital competence were considered by Victoria Vember, Andrii Gurzhii, Olena Kuzminskaya, Natalia Morse, Oleg Spirin and others. However, the peculiarities of the modern educational process determine the need for clarification of the studied phenomenon.

The purpose of the article is to theoretically substantiate the pedagogical conditions for the formation of information and digital competence in younger school students at Computer science classes.

The wide implementation of information technologies in the educational process gives rise to a number of problems related to the improvement of the content, methods, forms and

means of education, the integration of educational subjects and the fundamentalization of knowledge, the provision of modern computer equipment and software products, the training of pedagogical personnel in the system of continuous education, self-education and self-improvement professional skills of teachers, their mastery of the basics of information and digital competence.

Therefore, one of the most important directions of development is to provide the field of education with the theory and practice of using modern information technologies, focused on the implementation of learning and education processes. The implementation of the latest information technologies in education opens up great opportunities for improving educational pedagogical methods for the development of competences in the process of studying informatics. After all, informatics is the subject where learning for children turns into an exciting activity to the greatest extent, because it is in these lessons that the student learns to search, submit, process, transmit information.

The development of a comprehensive system for the development of information competence of junior high school students at Computer science lessons requires the solution of a number of problems:

- clarifying the structure of the student's information competence;
- identification and systematization of pedagogical conditions and methodical features of implementation of the content of Computer science education.

The urgency of the problem of forming the information and digital competence of younger schoolchildren is emphasized in the Concept of the "New Ukrainian School" (2016), which is based on the principles of the competence approach and provides for the formation of a number of relevant competences in students, one of the leading ones being information and digital, which involves confident and at the same time critical application of information and communication technologies (ICT) for creating, searching, processing, exchanging information at work, in public space and private communication [2].

The goal of forming the information and digital competence of elementary school students is to develop the ability of schoolchildren to navigate information flows, to determine what is important and necessary in them, to be aware of the need for reliable information, the ability to formulate questions, identify sources of information and use successful strategies for finding it, the ability to independently search, receive, systematize, analyze and select information necessary for solving educational tasks, as well as creatively process, store and transmit it; the ability to use software tools aimed at solving tasks in various spheres of activity [7].

Digital competence enables the student to be successful in the modern information space, manage information, make decisions quickly, and develop important life skills. Digital competence involves the ability to use digital technologies to support creativity, active citizenship and social integration, cooperation with other people to achieve personal, social or commercial goals.

With regard to information competence, a younger school student has the ability to work with a flow of information from various sources (textbooks, books, the Internet, mass media, etc.), process it and interpret it correctly.

In our opinion, computer science lessons are the most appropriate for the formation of information and digital competence, because in their process, large amounts of information, including foreign language, communication with native speakers via the Internet, etc. are

processed. Therefore, starting from elementary school age, students develop basic knowledge, which will eventually form a certain level of information and digital competence, which will be projected to other areas of their lives, including the study of other subjects provided by the program. Information and digital competence of students of lower grades provides an opportunity [6, p. 24]:

- analysis of mastery of the subject area in relation to disciplines;
- formation of cognitive interest in the studied disciplines;
- formation of abstract and algorithmic thinking of younger schoolchildren;
- formation of skills to analyze, generalize, systematize and select received information;
- the ability to detect changes in the surrounding world, to classify, to correlate the results of one's observations with the set goals;
- design and organize students' cognitive activities in order to gain experience working with information;
- analysis of any problem and development of an algorithm for its solution;
- development of algorithms for making fundamentally new decisions in unpredictable situations;
- modeling and construction of conditions and means, support and develop personal structures of students' consciousness, as the basis of their personal self-organization;
- use of ready-made software tools (teaching, training, controlling, etc.), participation in extracurricular activities, for the development of creative abilities;
- application of adapted methods of using ICT tools, application of author's methods of using ICT tools, use of electronic educational resources as a source of additional information;
- the combination of new information technologies and traditional means and methods of learning in the lesson based on cognitive, value-motivational, technical-technological, communicative and reflective approaches to learning;
- organization of communication in the student-computer-teacher system;
- organizing the work of younger schoolchildren in a team.

Therefore, in the course of our research, we identified and systematized certain pedagogical conditions that must be observed for the effective formation of information and digital competence in students, namely:

- the gradual formation of information and digital competence;
- systematic digitization of the computer science education process;
- proper motivational provision of the educational process.

The content of each component of the listed conditions implies a clear, consistent and methodologically competent construction of the educational process. When determining the pedagogical conditions for the formation of information and digital competence of younger schoolchildren, it is necessary to pay attention to the psychological and physiological features of this age period. At this age, the center of the child's mental development is the formation of the arbitrariness of all mental processes (memory, attention, thinking, organization of activities). At the end of it, they turn into higher mental functions, which are characterized by arbitrariness and indirectness. Arbitrariness is manifested in the ability to consciously set goals, seek and find means to achieve them, overcome difficulties and obstacles. This is

facilitated by the main activities of a child of this age at school and at home: study, communication, play, artistic activity, work, etc.

During the entire elementary school age, the child learns to manage his behavior and mental processes. Therefore, the younger schoolboy overcomes his desires and is able to control his behavior based on given patterns, which contributes to the development of arbitrariness as a special property of mental processes and behavior. It is at this time that you can implement a comprehensive program of intellectual development of students. For this, it is necessary to reveal the specifics of computer science education, the tasks of person-oriented education, the position of the teacher and the student in the educational process.

The analysis of the current practice in the aspect of this problem allows us to state that in recent years, with the introduction of the compulsory subject “Informatics”, the problems related to the search for methodological features of education corresponding to this age period, which will contribute to the formation of the information and digital competence of the individual, have been clearly highlighted.

Taking into account the age and psychological characteristics of younger school students, we can consider that it is worth laying the foundations of information and digital competence precisely at the primary level of schooling.

Therefore, children from 6 to 10 years old quickly master the skills and abilities of working with a computer, they develop imaginative thinking, a comfortable emotional background is created during learning, their independence in cognitive work develops, and the process of individualization of learning is strengthened. Younger school students develop basic knowledge, which will eventually form a certain level of information and digital competence, which will be projected onto other areas of their lives, including the study of other subjects provided by the program. Thus, according to computer science curricula for grades 1–4, schoolchildren should [7]: be able to use special software tools, games and create information objects; communicate using information and communication technologies; apply information and communication technologies for searching, processing, analyzing and preparing information in accordance with the assigned tasks; observe copyright and network etiquette.

The ability of students develops in the process of activity, so lessons should be structured in such a way as to take into account the age and individual characteristics of students, because difficult tasks can give a negative result (use of differentiated learning). The gradual and purposeful development of creative abilities and the development of the child's thinking should be taken into account. Special attention should be paid to the application of health-preserving learning technologies, namely: creation of favorable conditions for the child's education at school (absence of stressful situations, adequacy of requirements, teaching and upbringing methods); optimal organization of the educational process (in accordance with age, gender, individual characteristics and hygienic norms); full-fledged and rationally organized motor mode [5, p. 248].

Pedagogical conditions were implemented in the method of formation of information and digital competence of younger schoolchildren in computer science lessons and tested in stages.

The next condition for the formation of information and digital competence of younger schoolchildren is the systematic application of digitalization of the educational process.

Digitized teaching of informatics involves the use of digital technologies throughout

the lesson, preparation for this stage is traditional teaching with reinforcement of digital life hacks [3]. All this is carried out in the conditions of the information environment, which fully discloses the content of the transmitted educational information, lays down an idea of the main methods of activity related to the assimilation of forms and methods of working with various information, which contributes to the formation of the information culture of the schoolchild and the increase of interest in the methods of rational acquisition and processing information and development of general educational skills.

Since the knowledge, skills and abilities of students must represent a certain system, their formation must be carried out in such a sequence that the element of the educational material being studied is connected with its other element. Systematicity is the most effective didactic mechanism for the formation of project-technological competence due to the fact that the student constantly practices the educational material and, on the basis of this, forms certain knowledge, skills and abilities. With this in mind, educational work is planned, for which long-term (calendar) and current (for future classes) plans are drawn up. Generalization of the studied material plays an important role in creating a knowledge system. In general, implementing the conditions of systematicity and consistency in teaching, the teacher has [1, p. 36]:

- to use all stages of informatics for the formation of students' information abilities and skills, a holistic system of knowledge;
- to ensure students' assimilation of new educational material on the basis of previously acquired knowledge, skills and abilities;
- carefully and systematically plan the work for each subsequent lesson, establishing its connection with the previous and subsequent lessons;
- to systematically choose and apply together teaching methods that allow students to develop their cognitive and mental abilities, their creative thinking, attention, memory, to form the ability to plan and organize work;
- the use of collective work of students for the development of student self-regulation;
- education in students of an active life position;
- achieve continuity in subsequent classes.

The next condition is proper motivational provision of the educational process. Success in education and upbringing of children directly depends on motivation, i.e. the presence of significant and effective incentives for acquiring knowledge and acquiring certain personal qualities. Motives based on obtaining satisfaction from the learning process contribute to the development of interest in knowledge, curiosity, the desire to raise one's cultural level, enthusiasm for the process of solving educational and cognitive tasks. In this regard, it is necessary to follow the ways of forming positive motivation for learning:

1. Special organization of educational activities, which is implemented by creating an educational problem situation.
2. Availability of the content of the educational material offered by the teacher in the lesson.
3. Use of game elements in lessons; interesting presentation of the material.
4. Constantly creating and "reinforcing" a situation of success in learning (for example, a positive reaction to any manifestation of a child's responsible attitude to the fulfillment of his educational duties).

Proper motivational support of the educational process regarding the formation of information and digital competence is primarily provided by the use of computers and information technologies in educational activities. Along with this, the use of a computer makes it possible to make a gradual transition from the game type of activity, which is the leading type of activity for school-aged children, to educational activity. In this way, the computer is a teacher's assistant on the way to the child's development and education.

With the assimilation of information knowledge, the student should master rational methods of independent information search, both by traditional (manual) and automated (electronic) methods; master formalized methods of analytical and synthetic processing of information; use traditional and computer technologies to prepare and design the results of independent cognitive activity.

The formation of information and digital competence is not possible without the motivation of educational activity, which is provided in the use of various techniques, forms, methods and means, the involvement of students in activities with information, as well as exercises, tasks and problems with interesting content that will contribute to the motivation of students to work.

In order to ensure the positive motivation of younger school students in the process of learning computer science, we recommend using the following techniques [4]:

- actualization of already existing motives (praise for previous achievements);
- perspective motivation (showing the possibilities of using acquired knowledge in the future);
- praise when obtaining intermediate results;
- showing the correct pattern of action in a particular situation;
- “admiration of the final result”;
- exchange of roles “teacher – student”;
- creating a situation of rivalry;
- comparing the results of students who have a certain skill and those who do not;
- appeal to children's life experience (discussion with students of situations well known to them, understanding of the essence, which is possible only when studying the proposed material);
- creation of a problem situation or resolution of paradoxes (students are presented with some problem, overcoming which, the student acquires the knowledge, skills and abilities that he needs to learn according to the program);
- solving non-standard tasks for intelligence and logic (tasks of this nature are offered to students either as a warm-up at the beginning of the lesson, or for relaxation, changing the type of work during the lesson, and sometimes for an additional task solution. In addition, such tasks make it possible to identify gifted children);
- crosswords, scanwords, puzzles, games, etc. (this method allows you to monitor the level of knowledge acquisition).

In order for the student to really get involved in the work, it is necessary that the tasks that are set for him during the educational activity are not only understandable, interesting and informative. This will be facilitated by the game element – a mandatory attribute of every lesson in primary school. In informatics lessons, younger schoolchildren acquire computer

skills with the help of the game element of the lesson.

The game element of the lesson is also used to stimulate the independence and activity of each student, because in a game form they are offered tasks aimed at developing memory, attention and logical thinking with the simultaneous involvement of the computer. Although game computer programs carry a large didactic load, they still bring their fruits, which are supported by the variety of lesson forms and the wide application of game methods of learning and knowledge control.

All this is carried out in the conditions of the information environment, which fully discloses the content of the transmitted educational information, lays down an idea of the main methods of activity related to the assimilation of forms and methods of working with various information, which contributes to the formation of the information culture of the schoolchild and the increase of interest in the methods of rational acquisition and processing information and development of general educational skills.

In order to increase the level of formation of the information and digital culture of younger school students, it is necessary to interest them in the educational material and the process of mastering it and their rational use in further educational activities.

In order to effectively use the advantages of new information technologies, it is necessary to have an appropriate level of information culture. The information environment is an important condition for the formation of a culture of working with information and ultimately contributes to the improvement of the quality of education not only in information disciplines.

Studying an informatics course in elementary school should provide students with the primary skills of information culture as the basis of information and digital competence, namely:

1. Understanding the essence of information and information processes, their role in the knowledge of the surrounding reality and creative activity of a person, in the management of technical and social processes, in ensuring the connection of the living with the external environment.

2. Understanding the problems of presenting, evaluating and measuring information, its perception and understanding, the essence of the formalization of judgments, the connection between content and form, the role of information modeling in modern information technology.

3. Understanding the essence of non-formalized, creative components of thinking.

4. The ability to select and formulate a goal, set tasks, put forward hypotheses, build information models of researched processes and phenomena, analyze them using information technology tools and interpret the results obtained, systematize facts, understand and formulate conclusions, summarize observations, predict the consequences of decisions made, actions related to their implementation, and be able to evaluate them.

5. The ability to select the sequence of operations and actions in professional activity, to develop a program of observation, research, experiment.

6. Possession of computer skills, systems for processing textual, numerical and graphic information, knowledge databases, subject-oriented application systems, telecommunications systems.

7. The ability to adequately formalize the knowledge available to a person and to adequately interpret formalized descriptions, to maintain a proper balance between formalized

and informalized components.

8. An important component of information culture is mastering the basics of algorithmization. With this in mind, after getting acquainted with the main areas of computer application as a tool of activity, it is advisable to consider the principles of building algorithms (the method of step-by-step detailing “from top to bottom”) and the main basic structures of algorithms, with the optional study of any procedurally oriented or declarative language programming.

9. One of the main components of a person’s information culture is the ability to subordinate one’s interests to those norms of behavior that must be observed in the interests of society, the conscious acceptance of all those restrictions and prohibitions that are produced by the collective intelligence.

Therefore, thanks to the involvement of modern information and communication technologies in the educational process, it is possible to create favorable conditions for the formation of information and digital competence as an important component of the development of the innovative personality of all participants in the educational process. The formation of information and digital competence as one of the key ones should be started in primary school, in particular in computer science classes, since they have a significant potential for the formation of information and digital competence skills in the process of using various information and communication technologies in compliance with certain pedagogical conditions.

The conducted research does not cover all aspects of solving the chosen problem. We see the prospects for further research in the experimental verification of the effectiveness of pedagogical conditions for the formation of information and digital competence in computer science lessons in elementary school.

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