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# Development of Critical Thinking of Students in the Learning Process

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**Annotation:** The article discusses in detail some of the techniques of technology for the development of critical thinking. One of the personality traits necessary for the development of a future specialist in any industry and science is the ability to make reasonable decisions, process information, highlight the main ideas in it, and analyze facts and phenomena. In this regard, it becomes obvious that it is most expedient in the process of teaching computer science to use the methodological techniques of the technology for the development of critical thinking.

**Keywords:** learning technologies, critical thinking, cluster, conceptual table, pivot table.

The relevance is due to the situation of a person's excessive access to heteropolar information, the emerging objective need for its adequate assessment, decision-making in a situation of uncertainty and lies in the advanced preparation of students for independent life and activity in the information society as a citizen, professional, critically thinking person.

Both theoretically and methodically, the pedagogical problem of the development of critical thinking is poorly understood. An analysis of studies on this problem showed that initially the problem of critical thinking was studied by foreign psychologists (D. Dewey, R. Paul, D. Halpern, etc.). However, modern authors have pointed out the need for a theoretical solution to the problem of the development of critical thinking for the formation of personality (L.S. Vygotsky, S.L. Rubinshtein, A.A. Smirnov, B.M. Teplov, etc.).

The theoretical substantiation of the problem of the development of critical thinking in the process of teaching schoolchildren in our country is not fully the subject of scientific research by scientists and teachers. In our opinion, this is due to the axiomatic approach to the assimilation of knowledge acquired by schoolchildren, the authoritarian style of pedagogical activity in the classroom system, the lack of demand for the critical style of thinking in the modern system of government, including the education system.

The change in socio-economic guidelines in the development of society, the dynamism of progressive changes led to the emergence of a situation of uncertainty, the need for assessment and decision-making, greatly increased the role of the individual as a subject of social evolution, his ability to adequately assess the existing situation based on its critical analysis and build on it. the basis of the project of a successful solution to a given problem.

The success of solving the problem of adaptation of a person in a constantly changing environment of independent life and activity, in our opinion, lies, among other things, in the development of critical thinking already at the stage of schooling. Which, in turn, determines the theoretical and scientific-methodological substantiation and development of scientific recommendations for solving the problems of developing critical thinking in the educational process in general and in the study of subjects.

As a result of the analysis of these studies, we have identified a four-component structure of critical thinking:

For a person to be critically thinking, she needs certain knowledge and skills, as well as personal qualities and readiness for critical behavior. We reveal all this in the components of the structure of the development of critical thinking.

The cognitive component characterizes the cognitive abilities of schoolchildren, such as the perception of educational material, knowledge of the subject, knowledge of critical thinking. The use of this cognitive knowledge increases the likelihood of obtaining the desired result, that is, the developed critical thinking of schoolchildren.

The analytical component includes such forms of thinking as consistency, reflection, checking the accuracy of statements. Let's consider them in more detail.

Logic is the development of the sequence of the thought process, the rigor of the proof, the ability to draw generalizing conclusions [106]. Consistency is necessary for the development of critical thinking, since information must be analyzed from the standpoint of logic.

Reflection is the process of self-knowledge by the subject of internal mental acts and states. Reflection is usually considered in connection with a person's ability to self-development and with this process itself. Students should be able to apply what they have learned to both standard and non-standard situations.

Verification of the accuracy of statements (assessment) - establishes the absolute or comparative value of any object or problem. Without evaluation, critical thinking is impossible. Many researchers call critical thinking evaluative and include evaluation as one of the main features of critical thinking.

The personal component reveals the qualities of a person capable of critical thinking.

Today we can talk about the exhaustion of the classical pedagogical paradigm, according to which the personality was determined to a greater extent by the structure and nature of its objective activity, and the formation of the personality was carried out according to the given properties.

A schoolchild, mediating by his activity the diverse and numerous influences of social institutions of education, is a true subject, because, being open to pedagogical influences, he perceives them selectively through internal attitudes, beliefs, values that can be successfully formed within the personality development complex. [5]

We have identified the following qualities:

1. Tolerance to a situation of uncertainty - tolerance for a different opinion, open-mindedness in assessing people and events.
2. Skepticism - a distrustful attitude towards something, a doubt about the truth and correctness.
3. Independence - the quality of a person, expressed in the ability to set a specific goal, persistently achieve its implementation on their own, take a responsible attitude to their activities, act consciously and proactively; the ability to see for yourself the question that needs to be solved, and independently find the answer to it.
4. Pragmatism - the ability to build your own system of actions and views on life in terms of obtaining practically useful results.
5. Integrativity - the ability to combine previously homogeneous parts and elements into a whole.

The activity component is skills that contribute to the development of critical thinking. The ability

to solve problems, offer constructive solutions includes the ability to eliminate external obstacles to achieving goals. The ability to make forecasts is to master the principles of forecasting and planning. The ability to search for logical errors - possession of the basic laws of logic. Another necessary skill for the development of critical thinking, we consider the ability to conduct a dialogue, to discuss. After all, it is in the discussion that the right ideas are born. Dialogue can be internal, with oneself, and external, with a teacher or students. With an internal dialogue, several ways of solving a problem are analyzed, with an external dialogue, someone else's opinion is taken into account, which is analyzed and comprehended.

Based on the analysis of psychological and pedagogical literature we have identified the following functions of critical thinking:

1. Regulatory function - the ability to deliberately act and direct their actions in accordance with objective conditions. It carries out the transition from the preliminary solution of a problem or problem to the final solution.
2. Evaluative function - evaluation of one's own and others' judgments and actions.
3. The function of initiation is manifested when a cognitive contradiction is detected and corrected. In the conflicting data of the problem being solved, find the necessary ones and use them to solve the problem.
4. Stimulating function - critical thinking stimulates the need for new knowledge, skills, as well as putting forward new hypotheses, interest in independent research, ways to solve problems.
5. Corrective function - rational selection of the necessary material, information retrieval. The student also corrects his activity with the help of the teacher: his conscious attitude to the results should become an incentive for the upcoming activity.
6. Predictive function - orientation to the future, to the prospects. A student who is able to predict in advance the course of solving a problem and predict the development of a situation has a high level of critical thinking.
7. Modeling function - creating a model of actions and results. The modeling function involves the creation of mathematical models of objects of study; focused on abstraction and idealization. Physics often uses models of processes or phenomena to demonstrate and study them more clearly. An example is the model of an ideal gas or a mathematical pendulum.

The study of the development of critical thinking in the learning process at the present stage is due to the intensive development of science and technology, as well as an understanding of the social significance of critical thinking as the basis for the development of human society.

In the psychological and pedagogical literature, the following definition of development is given.

Development is a philosophical category that expresses the process of movement, change of integral systems.

The driving forces of development are those contradictions that arise and are overcome in the process of life. The main groups of contradictions: between high needs and a low level of development, between the environment and the level of development, between the level of development and the form of activity.

Development is the process of formation of quantitative and qualitative neoplasms of the physical and mental properties of a person. Development as a process is characterized by stages and unevenness.

The concept of development in modern foreign psychology has also influenced the understanding of the development of thinking. Such major researchers of thinking as J. Piaget, V. Stern rely on the idealism of the nature of thinking in conjunction with biologism as a "driving force".

V. Stern as the main "law of development" puts forward the assumption that development occurs through certain, predetermined stages. V. Stern himself notes that in this understanding, the development of thinking is a special case of a "very broad law of development." That is, the development of a child's thinking is a spontaneous process, due to internal and external factors.

K. Buhler has a similar concept. The development of a child's thinking is determined only by biological maturation. K. Buhler and V. Stern emphasize the role of speech in the development of thinking.

J. Piaget raised the question of the development of thinking more deeply than anyone else. His theory of the development of thinking was called "operational". An operation, according to J. Piaget, is an "internal action, a product of the transformation of an external, objective action, coordinated with other actions into a single system, the main property of which is reversibility."

In the development of thinking in children, J. Piaget identified the following stages:

1. The stage of sensorimotor intelligence, covering the period of a child's life from birth to about two years. It is characterized by the development of the ability to perceive and cognize the objects surrounding the child in their fairly stable properties and features.
2. Stage of operational thinking, including its development at the age of two to seven years. At this stage, the child develops speech, an active process of interiorization of external actions with objects begins, and visual representations are formed.
3. The stage of specific operations with objects. It is typical for children aged 7-8 to 11-12 years. Here mental operations become reversible.
4. Stage of formal operations. In their development, it is reached by children in middle age: from 11-12 to 14-15 years. This stage is characterized by the child's ability to perform mental operations using logical reasoning and concepts. Internal mental operations are transformed at this stage into a structurally organized whole.

J. Piaget, introducing these stages, emphasized the difference between the thinking of a child and an adult. However, he opposed them to each other, essentially breaking the unity of human mental development.

According to these scientists, as the child grows up in the development of thinking, the main stages or structures are distinguished, which are not interconnected, determined by the biological laws of this age. However, this theory does not take into account the importance of learning, during which the child acquires certain knowledge, skills and abilities. Therefore, we believe that the development of thinking cannot be considered only as a biologized spontaneous process.

P.Ya.Galperin introduced new ideas into this area of research. In particular, he developed a theory of the formation of thinking, called the concept of the systematic formation of mental actions. He singled out the stages of internalization of external actions, determined the conditions that ensure their most complete and effective translation into internal actions with predetermined properties.

According to P.Ya. Galperin, the process of transferring an external action inward is carried out in stages and has strictly defined stages. At each stage, the given action is transformed according to a number of parameters. Galperin P.Ya. in his theory, he claims that a full-fledged action, i.e. action of the highest intellectual level cannot be formed without relying on previous ways of performing

the same action, and as a result, on its original, practical, visually effective, most complete and expanded form.

Four parameters are known, according to which the action is transformed when it passes from outside to inside. These are the level of performance, the measure of generalization, the completeness of the actually performed operations, and the measure of development. According to the first parameter, the action can be on three sublevels: action with material objects, action in terms of loud speech and action in the mind. Three other parameters characterize the quality of the action formed at a certain level: generalization, abbreviation and mastery.

The process of formation of mental actions, according to P. Ya. Galperin, is presented as follows:

1. Familiarization with the composition of the future action in practical terms, as well as with the requirements (samples) that it will eventually have to meet. This familiarization is the orienting basis for future action.
2. Performing a given action in an external form in practical terms with real objects or their substitutes. Mastering this external action follows all the main parameters with a certain type of orientation in each.
3. Performing an action without direct reliance on external objects or their substitutes. Transfer of action from the external plan to the plan of loud speech. “Transferring an action into a speech plan,” P.Ya. Galperin believed, “means not only the expression of an action in speech, but, above all, the verbal performance of an objective action.”
4. Transferring the loud speech action to the internal plan. Free pronunciation of the action entirely "to oneself."
5. The performance of an action in terms of inner speech with its corresponding transformations and reductions, with the departure of the action, its process and details of execution from the sphere of conscious control and the transition to the level of intellectual skills and abilities.

The development of thinking occurs in several stages. The boundaries and content of these stages vary by different authors, which is directly related to the author's position on this issue. In modern science, there are several of the most famous classifications of stages in the development of human thinking. However, among the generally accepted concepts and teachings, one can also find something in common.

The development of the child's thinking occurs gradually. At first, the manipulation of objects predominates, which, not meaningful at the beginning, eventually begins to be determined by the object to which it is directed, and acquires a meaningful character. The intellectual development of the child is carried out in the course of his objective activity and communication, in the course of mastering social experience.

In the psychological, pedagogical and methodological literature, the main criteria for the development of thinking are distinguished, that is, indicators that indicate the achievement of one or another level of development of the thinking of students.

We highlight the following criteria:

1. The degree of mastery of operations and methods of mental activity, the ability to perform rational actions for their application in educational and extracurricular cognitive processes.
2. The degree of ability to carry out the transfer of awareness of operations and methods of thinking, as well as the skills to use them in a different situation and on other objects.

3. The degree of awareness of operations and methods of mental activity.
4. The degree of formation of various types of thinking, as well as the state of thinking in the process of growing one of its types into another.
5. The degree of ability to creatively solve problems, navigate in new conditions, be prompt in actions.
6. The size of the thesaurus, i.e. the stock of knowledge, its consistency, as well as the emergence of new ways of acquiring knowledge.
7. The state and increasing dynamism of various qualities of the mind: independence, depth, criticality, flexibility, consistency, speed, etc.

An analysis of the psychological and pedagogical literature has shown that it is impossible to solve the problem of the development of critical thinking outside of intellectual activity.

Consider the problem of developing critical thinking as one of the types of thinking.

The problem of developing the critical thinking of schoolchildren was developed by many foreign researchers. In these studies, the problem was considered from several angles. In one of the approaches, the process of thinking and cognition was reduced to imitation of the teacher, who acted as a standard of knowledge. Students had to receive a certain set of knowledge, skills and abilities that they could apply in the future without outside help.

Another approach was based on the equality of the roles of the teacher and students, the dialogization of the learning process, when the teacher leads students to solve the problem.

Education is a purposeful pedagogical process of organizing and stimulating active educational and cognitive activity of students in mastering scientific knowledge, skills and abilities, developing creative abilities, worldview, moral and aesthetic views and beliefs.

The learning process is the movement of the student under the guidance of the teacher along the path of mastering knowledge.

The learning process is the interaction of a teacher and a student, focused on mastering the student's educational material, introducing him to culture, contributing to the development and self-development of the pupil. [89]

The educational process is a specially organized, purposeful interaction of teachers and pupils in solving educational, educational and developmental tasks and, as you know, is bilateral in nature, which is reflected in the development of its models.

The elements of the structure of a holistic person express varying degrees of specification of the requirements for the structure of pedagogical activity and the educational process aimed at its formation, up to isomorphism. The nature of a person and his personality, their structure, the laws of internal development should be considered as an image on which pedagogical education is built, that is, a specific idea of a person contains an indication of the nature and methods of teachers' activities in relation to the student and the team. They should be modeled in the educational process.

Education is, first of all, a set of sociocultural skills, elite knowledge, attitudes and values necessary for their active

The ability for reflection, and hence for developed critical thinking, students receive as a result of self-organization of thought processes, which occurs in conditions of joint learning activities. Efficiency in training is determined by the level of development of a particular type of thinking. The predominance of one or another type of thinking is manifested in the specifics of problem

solving, in the preference for a method of action, which does not exclude the possibility of solving the problem.

One of the factors in the development of critical thinking is taking into account the age characteristics of students.

In adolescence, theoretical thinking, the ability to establish the maximum number of semantic connections in the surrounding world gradually become a priority. A teenager is psychologically immersed in the reality of the objective world, figurative-sign systems, nature and social space. It is at this age that formal thinking is developed, that is, a teenager can already reason without linking himself to a specific situation, can act according to logic. A teenager takes a huge step in his development when he begins to focus on the potential, and not just the obvious. This characterizes the speed with which a teenager reaches the level of theoretical thinking, determines the depth of his understanding of educational material and the development of intellectual potential. However, in real life, many teenagers fail to make this leap, and continue to remain at the level of concrete thinking for some time. This may be due to the peculiarities of individual development. But, nevertheless, after a while, the teenager will inevitably overcome this level. The modern teenager today has free access to the so-called virtual realities. They, depending on the conditions of use, can have both a positive and a negative impact on the ability to establish semantic connections in the surrounding world.

A teenager is already quite able to subjugate attention, memory, imagination. For him, semantic memorization becomes the dominant mechanism. Imagination at this age can turn into an independent internal activity. The events taking place in the imaginary world are mediated by images and signs from the reality of universal culture - they affect the personality of a teenager with all their certainty. But a teenager is engaged in arranging his inner world subjectively, of his own free will. The imagination of adolescents can influence cognitive activity, the emotional-volitional sphere and the personality itself.

During adolescence, the richness of the vocabulary expands and the assimilation of the many meanings that the vocabulary of the native language is able to encode.

A teenager, depending on the style of communication and the personality of the interlocutor, is able to vary his speech. It follows from this that each interlocutor, as a native speaker, offers his own composition of used words, meanings and meanings.

A teenager is also characterized by a very noticeable, even rapid development of independence, critical thinking. These factors confirm a new area for the development of the mental activity of a teenager in comparison with a younger student.

Self-awareness during this period in a teenager, under the influence of schooling, which is characteristic of his growth, develops the ability and need to think independently. He strives to have his own opinion, his own views and judgments on a variety of issues, without listening to the authority of parents, teachers or textbooks. Therefore, a teenager is so prone to disputes and objections, and in a categorical form (teenage maximalism).

The development of critical thinking in a teenager can, in certain cases, go along the path of “forming autistic criticism”, a kind of habit not so much of thinking independently, but of doubting, arguing, objecting, raising questions, defending obviously erroneous positions. The teenager is attracted not by the desire for truth, but by the process of “crossing arguments”. In this case, of course, this is an undesirable line of development. Therefore, the teacher must tactfully and skillfully respond to the behavior of a teenager, showing the futility, uselessness of such disputes and objections, and suggesting another “field of application” for educating the skills to think

independently and critically.

Teaching the subject in the basic school is aimed at achieving the following goals:

- development of cognitive interests, intellectual and creative abilities in the process of solving intellectual problems, tasks and performing experimental research; the ability to independently acquire new knowledge in subjects in accordance with vital needs and interests;
- fostering confidence in the cognizability of the surrounding world, in the need for a reasonable use of the achievements of science and technology for the further development of human society, respect for the creators of science and technology; attitude to objects as an element of universal culture.

To achieve positive results in achieving the goals set, the features of the subject of the school can help.

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