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FUNCTIONS OF ALGORITHMIC THINKING IN THE PROCESS OF DEMONSTRATING CHESS SKILLS

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LET'S THINK ANOTHER WAY
Steve Jobs

New ideas will not come to you if you sit down and wait for them. Talk to people, watch the world, get out of the closed house-work chain, ask yourself questions and look for the answers. Try it. **You will never know what you are looking for until you find it.**

Technological upgrades, progressive scientific and technical developments are a direct reflection of the challenges of the 21st century, the overcoming of which implies a review of the content of education and the results obtained from it, aimed at developing a creative, self-planning, results' predicting personalities. The acquisition of the mentioned qualities is ensured by the introduction of a chess game in the educational process, the purpose of which is not only to learn chess, but also to develop cognitive, emotional qualities at young age (Karapetyan & Misakyan, 2020), action prediction, thinking quality, decision-making quality, performing analytical actions (Kasparov, 2007).

However, the mentioned approaches apply to primary school children, while we try to discover new age opportunities by introducing these chess elements in pre-school educational institutions, assuming that the mentioned abilities may be available to pre-school children as well. As for the relevant specialists, it can be stated that the system of training specialists, with its multi-vector developments, is practically directed to the formation of a specific priority type of thinking. After all, the processes of receiving, processing and transmitting information include not only elements of sensory knowledge, but also natural manifestations of certain connections.

Information retrieval and processing is related to the discovery of causal links, the find out possible causes, which, in fact, presupposes the existence of programming skills (Karapetyan, 2020). It is estimated that 90% of new professions will require programming skills in the future, and on what thinking basis? The solution to the problem of child programming today requires the development of logical-creative thinking, which can eventually lead to the introduction of quite complex projects. Through the introduction of educational programs, algorithmic-logical thinking is considered within the framework of the educational subject, which, in fact, is a mandatory component in the field of programming and robotics. Algorithmic-logical ways of thinking, in their diversity, however, are specified in various spheres of life. In the case of chess, it is more appropriate to formulate the idea that "To understand someone else's algorithm means to understand your own one". The algorithm as a unique way of thinking and style,

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the application of thinking schemes with complete observations, are sequential actions that develop the child's intellectual abilities with both logical and pictorial thinking. The creative potential, based on logical thinking, shifts to algorithms. Algorithms and the development of algorithmic skills in the learning process leads to the effectiveness of children's educational activities, which is a prerequisite and effective means of intellectual development in the process of developing chess knowledge. A question arises; in terms of intellectual capacity development, what are the preconditions for emphasizing the unique role of algorithmic thinking in elementary school, especially when teaching chess?

At the conceptual level, many authors have addressed the child's cognitive motives, cognitive interests (Bruner, 1977; Davydov, 1996; Piazhe, 1965; Fress & Piazhe, 1975; Leontev, 1971, 2012), aspirations, memory, attention, mental processes, emotional-behavioral qualities (Vygotskij, 2005).

Knut (2002) views an algorithm as the final set of rules that establishes a sequence of operations to solve specific problems. Programming is essentially a process of creating and applying algorithms.

The algorithmic thinking is the art of arguing about the algorithmic processes of the surrounding reality, the ability to plan the actions involved, the ability to plan different actions involved, to predict different scenarios and to agree on them. However, systematic studies of algorithmic thinking, programming, and planning do not sufficiently consider the possibilities of developing algorithmic thinking in any subject so that they can be applied in other subjects. In chess, on the other hand, the "reflection of hidden actions" as a revelation-evaluation, brings us closer to the practical side of algorithmic thinking, which is one of the necessary conditions for planning cognitive activities. After all, any planning process presupposes ensuring a sequence of actions. Everyone should plan to learn because it teaches thinking. In fact, the game of chess is the application of the chosen sequence of actions, but this is already a problem of children's programming.

A Brief Description of the Functions of Algorithmic Thinking

The value of algorithmic thinking as a necessity for a new type of educational outcome is focused on accomplishing or solving real-life tasks. The child has a number of general educational skills, as the mental apparatus is formed, includes the development of logical-algorithmic thinking. The goal of purposefully chosen moves (actions) during a chess game, with its changes, is the ability to be continued until the end of the game.

If we list the actions in chess according to the sequence of performance, it will become clear that regardless of everything (position analyzing, moves' studying, etc.) the actions are mental in the conditions of the process. Of course, first the children test the move in their minds, then they take it. The priority is to develop the ability to plan at the level of individual moves and stages, but in the end, as a result, the child masters the practical, intellectual-cognitive tasks and general methods of solution.

Specific functions of algorithmic thinking. By mastering the intermediate and final results of their activities, monitoring and evaluation activities, children can first plan their goal, steps (actions) and then implement them.

Algorithms and algorithmic skills are an effective way to develop the preconditions for children's educational activities in the learning process. After all, an algorithm is a way of accepting and maintaining the purpose of its future chess learning activity, which is a sequence of moves (functions) for the implementation of practical-educational tasks. Mastery of the algorithm, as a method, allows to solve the chess problem or perform similar tasks, as their abilities are not only constantly generalized, but also become transferable in the process of clarifying new chess situations. The actions of monitoring, self-control and directing are very typical of algorithmic thinking. These are essential functions. The sequence of moves (actions) is performed in a strictly defined manner, at least once. The algorithm is characterized by the fact that there is a condition that must be followed, if it is fulfilled, we will have a sequence of moves in one direction, if not, then there is another direction (in the case of networking). There is also another approach, for example, the Cyclic algorithm contains a few operations that need to be repeated several times before a certain condition is met.

Among the subjects taught in primary school, the teaching of chess, in addition to its standard orientations, basically reveals the existence of 3 types of algorithms.

Linear algorithm, when chess moves (actions), transitions go in only one direction - a clear "straight line".

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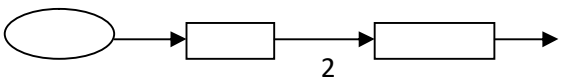

Let's bring simple examples from chess.

Example N 1

In a given position (see Diagram 1) it is the whites' turn; mate in 7 moves.

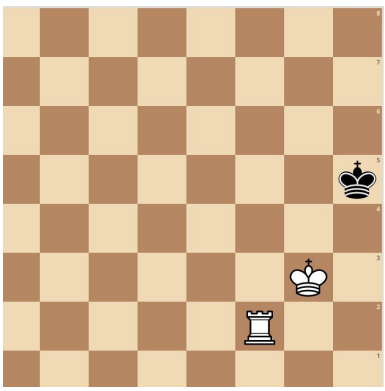

Diagram 1

Whites can mate the black king only on the edge line. Therefore, one should try to keep the black king on the edge line. The position of the white king is not favorable in the given position; therefore, his position needs to be improved. The white king must bypass the black king by 1. Kg3-f4 move, to prevent him from escaping from the edge. But the black king tries to go away from the edge by 1.… Kh5-g6 move. It is natural that the white king moving 2. Kf4-g4 opens the way for the rook to prevent the black king from escaping. The black king is obliged to do the following move 2.… Kg6-h6. The white king with the same logic tries to bypass the black king moving 3. Kg4-f5, to keep him on the edge. Of course, the black king will not stay on the edge line, he will try to escape from the edge line with 3.… Kh6-g7 move. The white king, again moving 4. Kf-g5, opens the way for the rook, not allowing the black king to escape from the edge. The black king is forced to move to the edge by 4.… Kg7-h7. Once again, the white king tries to bypass the black king moving 5. Kg5-f6 to keep him on the edge line. Of course, in this position the moves of the black king 5.… Kh7-g8, or 5.… Kh7-h8 are almost equivalent, because in the first of the mentioned moves the white king makes a move 6. Kf6-g6, followed by the only 6.… Kg8- h8 move, followed by 7. Rf2-f8 #. And the move of black's 5.… Kh7-h8, is responded by the whites' 6. Kf6-f7 move, followed by 6.… Kh8-h7, the whites have to mate by 7. Rf2-h2 move.

Chess example N2

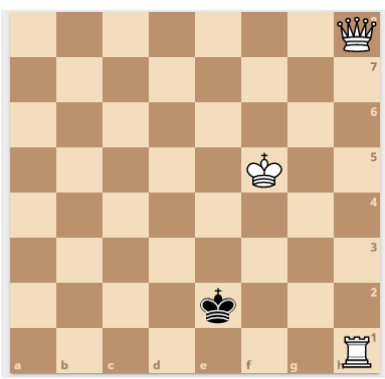

Diagram 2

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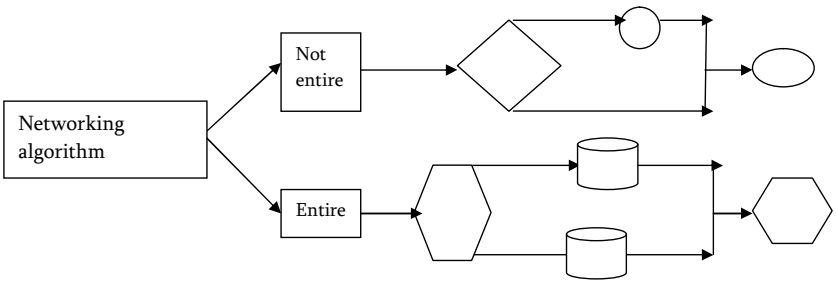
Mate in 2 moves. The white king moves to e4 and then the white queen moves to h2.

In the next position (see Diagram 2), the whites mate the black king in two moves. There are 10 different solutions to this problem. The planning of moves is aimed at constraints the black king moves. To do this, first the white king moves (e4), then the white queen moves (h2). The variety of moves does not yet indicate a networking algorithm.

Networking algorithm, when it is necessary to move in the direction of the goal in 2 and more directions.



It is commonly used in chess teaching.

Chess example N 3

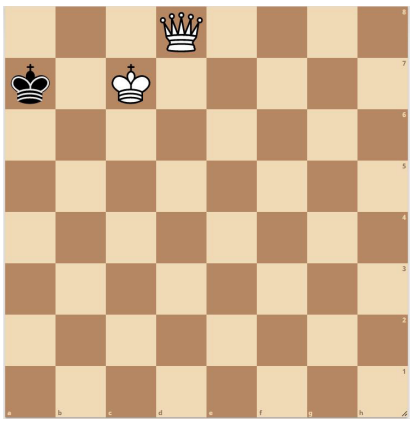


Diagram 3

To find the solutions to the problem, the set of solutions can be divided into four subsets. This is also an example of networking algorithm, according to the priority of the goal, because the goal is also an action (as a verb).

1. The whites can check the black king by the first moves, those are two: 1. Qd8-b8 +, 1. Qd8-d4 +, the mentioned moves can be responded by 1.… Ka7-a6, followed by 2. Qb6 #.
2. The whites can control the a6 with the queen with the first move, and they can do it with 1. Qd8-d6, 1. Qd8-f6, 1. Qd8-d8-d3 moves, to which the blacks will respond by 1.… Ka7-a8. And the white mate with 2. Qa6
3. The whites may not control the a6 with the queen but allow the blacks to move to the a6 with the king. Of course, in this case, the white queen must control the a4, in order to mate from that square. That's why the whites take the following moves with the queen. 1. Qd8-e8, 1. Qd8-d7, 1. Qd8-h4, 1. Qd8-d1, which will be followed by the possible move of the black king 2. Qa4 #.
4. Of course, we should not forget about the possible move of the white king. The white king's move 1. Kc7-c6 is responded by the black king 1. Ka7-a6, followed by 2. Qd8-a8#, or 2. Qd8-b6#.

Combined algorithm, the use of which presupposes the existence of a linear and networking algorithms, which we have already discussed.

Thus, the algorithmic way of thinking greatly contributes to the development of systematic knowledge and skills, also in chess subject's teaching.

The study of chess positions and mate situations leads to programming, and the algorithm defines a clear sequence of steps in the form of a linear or networking algorithm. The ability to think is becoming one of the most important priorities in the culture of modern high-tech applications in the world; the teaching of chess brings us closer to the gradual solution of this complex problem.

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