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THE INTEGRATION OF CHESS AND MATHEMATICS AS A PREREQUISITE FOR ENHANCING THE QUALITY OF EDUCATION

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ABSTRACT

Numerous studies have proven that chess indicates a player's mental skills and ability to think. The goal of our study is to explore the process of learning chess in elementary school in the context of the integration of mathematics and chess, as well as to develop and offer methodological suggestions that will improve the efficiency of understanding mathematics. By solving non-standard "chess" problems in math classes and extracurricular math lessons, the link between chess and the development of spatial thinking can help to foster the development of a unique capacity to operate in the mind.

Key words*: Chess, mathematics, interdisciplinary connection, integration, thinking, analysis, attention, self-organization.*

The problem of the research. Mathematics and chess are two subjects that provide issues and problem-solving scenarios that enable children's mental activity to grow and activate, resulting in the development of intelligence, attention, logic, focus,

responsibility, balance, and diligence.

This phenomenon is a one-of-a-kind result of the integration of chess and mathematics and determines the urgency of the research of the topic we have chosen.

In the new state standards of general education, a great deal of attention is paid to interdisciplinary relations, including chess. In particular, "mathematics is presented in grades 1-6 with one integrated subject, in grades 7-9 and grades 10-12 with separate mathematical subjects, as well as in grades 2-4 with mathematical thinking, critical thinking, making predictions in a separate subject that develops skills by teaching the game of chess." Many research on chess' educational usefulness focus on the improvement of pupils' mathematical ability through chess. A lot of studies have been conducted to investigate the relationship between chess and mathematics. Despite the fact that chess has been taught as a compulsory subject in the Republic of Armenia elementary schools for over a decade, professionals have yet to thoroughly examine these issues. Furthermore, despite the fact that the newly developed general education standards explicitly mention integrated mathematics and chess teaching, there is still a lack of methodological materials that will allow this process to be carried out in a systematic manner.

In the process of playing chess, the use of children's thinking, combination, development of analytical skills, types of thinking in the subject of mathematics and thus increase the efficiency of mastering mathematics in elementary school. Philip Rifner in his research project called "**Problem-Solving Skills in Students with Average and Above Average Intelligence"**, stated that, the inter-domain transfer of chess skills can be achieved if teaching for transfer is an instructional goal (Philip Rifner, 1992).

Analyzing the interconnections of chess knowledge with the indicators of progress in mathematics and native language in primary schools **Sargsyan V. ZH., Manukyan S. A., Sargsyan T. A., Gevorgyan L.L.** to the question "*What are the connections and interactions between chess, native language and mathematics grades and chess achievement indicators*", stated that based on the available data, the semi-annual grades of "chess", native language and mathematics subjects express similar tendencies. Referring to the connections between the grades of the native language and mathematics subjects and the indicators of chess achievements, it has been revealed that along with the increase of semester grade of the native language, the increase of the grade of the chess test begins to be expressed (Sargsyan V. ZH., Manukyan S. A., Sargsyan T. A., Gevorgyan L.L., 2021). Authors also provide clear evidence that "in parallel with the increase in the semester grades in mathematics, the grades in the chess test are

increasing”

Analyzing the effect of substituting a weekly mathematics lesson in primary school grades 1 ± 3 with a lesson in mathematics based on chess instruction. In the City of Aarhus in Denmark, combining test score data with a comprehensive data set obtained from administrative registers. Authors found positive effects, indicating that knowledge acquired through chess play can be transferred to the domain of mathematics. The results suggest that chess may be an important and effective tool for improving mathematical capacity in young students (Rosholm, M., Mikkelsen, M. B., & Gumede, K., 2017).

The aim of the research is to discuss the process of studying chess in elementary school in the context of the integration of mathematics and chess, to develop and present methodological guidelines that will increase the efficiency of mastering the subject of mathematics.

The connection with chess and the development of spatial thinking can contribute to the development of a unique ability to think in math lessons and extracurricular math classes by solving non-standard "chess" problems.

Integrated teaching in modern pedagogy is presented with new observations. It is evolving in nature, multi-component in content, which includes both students with disabilities, the use of interdisciplinary connections, and processes in multidisciplinary classrooms. Ideas on integrated teaching were once expressed by a number of pedagogues: J. A. Comenius, J. H. Pestalozzi, V. Sukhomlynsky, I. P. Podlasin. As mentioned by E. A. Yekzhanova, "Integrated teaching, based on the principles of special and general education, should have a developing, educating profile, which implies the development of students' moral ideas, adequate forms of behavior, including all participants in the educational process. (Ekzhanova E. A. Reznikova E. V., 2008)

Organizing the lesson process through integrated learning enables the educator to carry out purposeful work, motivating learners to perform logically related activities: comparison, generalization, association, combination, classification, analysis. These activities provide a full and multi-layered understanding of the material being conveyed, deepening and broadening the learners' perceptions of the subject, making the learning process more interesting. And the emergence of interest in the learning process itself contributes to the formation and development of learners' learning motivations, which is the problem of the modern education system. In other words, the pedagogue is able to solve the important problem of didactics through the implementation of integrated teaching, the development of students' cognitive qualities, giving the teaching process a creative nature.

When evaluating the importance of education, we must consider that education may help to promote public thinking, spiritual-moral, and cultural values. Integrated learning, by ensuring the combination of knowledge of different subjects, contributes to the formation of research skills, creative abilities and their sustainable development based on them. According to N. N. Marphinine, sustainable development is a way of organizing life, from the solution of problems to the prediction of conflicts, the planning of actions aimed at overcoming or weakening them (Marfenin N. N., 2011). This will be the primary guarantee for boosting educational quality and establishing a new society.

Integration of sciences and the quest of a more accurate representation of the overall picture of the world are urgently needed at the moment. These ideas are reflected in the perspective of modern school education. But it is impossible to solve such a problem within one subject. Therefore, interdisciplinary generalizations are used in teaching theory and practice.

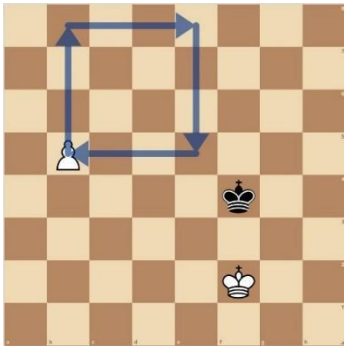
Interdisciplinary connections play an important role in the development of systemic thinking and the construction of general educational abilities in students, as they reflect the interconnections of phenomena and processes in the surrounding environment: they enable the transfer of abilities and skills formed as a result of teaching a subject to the field of other subjects.

Thus, while it is simple to create a final and a number of intermediate goals in chess, it is very hard to provide a clear prescription for reaching them. The decision-making process in a chess game that takes into consideration the conditions and the capacity to combine and assess diverse situations, producing varied conclusions. Undoubtedly, chess and mathematics are directly related to each other, as the above is also typical of mathematics. Thinking about the next step, the chess player and the problem-solving mathematician make their own brain do a tremendous job. There is a chain of logical reasoning, a work of the subconscious, and a back-up memory application that develops visual associations. The variety of mathematical tricks allows you to facilitate the chess player's judgments.

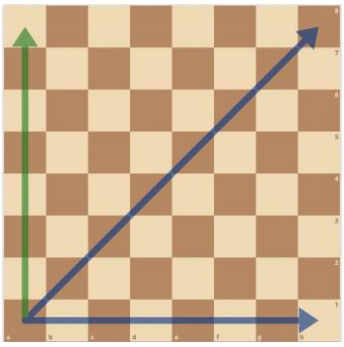
Thus, we can prove that there is a connection between chess topics and mathematics, which can be briefly presented as follows:

1. Familiarity with the concepts of **square, angle, line and radius, polygon, and circle** when learning chess board and solving tasks (see Activity 1-3).

Activity 1



Activity 2



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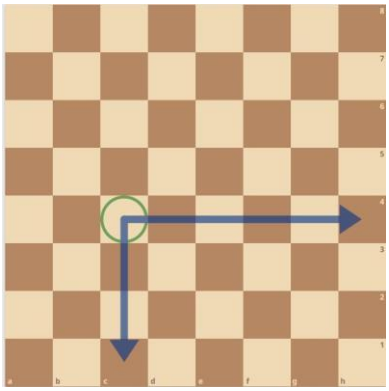


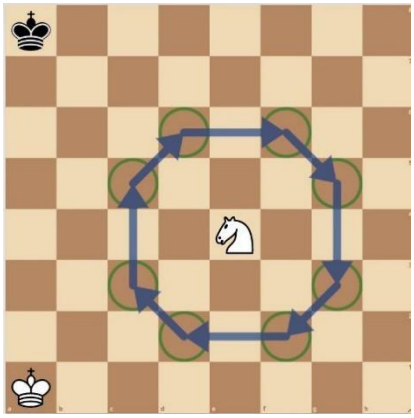
Comparative analysis of the stages of solving mathematical and chess problems aimed at divergent thinking of primary school learners V. Karapetyan, Samvel Misakyan, Shushanna Sargsyan

When solving a chess problem, additional skills are required by the learner.

- Imagining the given position in the mind,
- Calculating the approximate values of the pieces.
- Moving them in the mind without touching the pieces,
- Imagining each new position in mind,
- Discussing and calculating possible steps in the new positions,
- Seeing the intersections of the traces of the pieces
- Creating checkmate positions for the opponent's king.

2. Memorizing the names of the chessboard fields is equivalent to learning the position of a point on a surface, which is equivalent to identifying the coordinates of a point on a surface (see Activity 4).

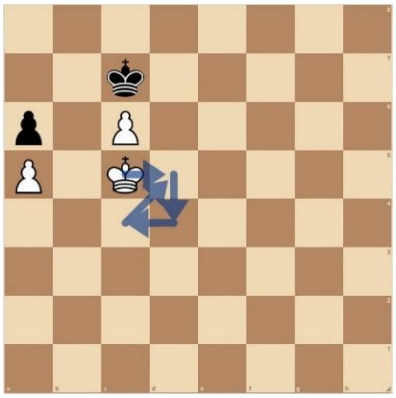
Activity 4



1. When calculating the approximate values of chess pieces, learners use the addition and comparison of one-digit numbers.

2. Teaching the step "pawn's en passant" provides a basis for imagining the typical position of that step in the mind (see Activity 5).

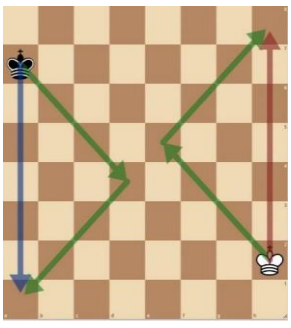
Activity 5



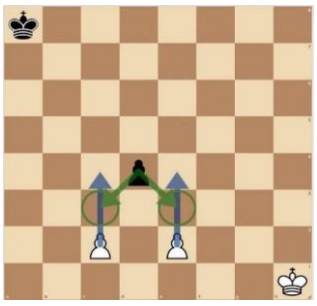
3. Learning to mentally calculate steps when solving problems and tasks is the foundation for solving mathematical calculation problems.

4. Solve chess problems using geometric shapes such as squares, **dashed lines** (**բեկյալ գիծ**), and triangles (see Activity 6-8).

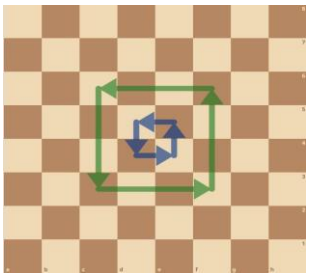
Activity 6



Activity 7



Activity 8



CONCLUSION

We can draw the following conclusions by studying the interdisciplinary connections between mathematics and chess in the context of integrated learning and developing and presenting methodological guidelines that will aid in the formation of unique ability and spatial thinking in elementary school students by solving non-standard "chess" problems.

1. Chess and mathematics, as we have seen, are theoretically and practically shown to be closely linked. The chess player and the problem-solving mathematician both require their minds to work extremely hard when thinking of the next move.

2. We may claim that the relationship between chess topics and mathematics can be expressed in a variety of ways, among which we can identify a number of topics that will help to solve the problem of chess and mathematics integration in elementary school.

- Familiarity with the concepts of square, rectangle, angle, line and radius when learning chess board and solving tasks.
- Learning the names of the fields on a chessboard is the same as learning the position of a point on a surface, which means determining the coordinates of a point on a surface.
- When calculating the approximate values of chess pieces, learners use the addition and comparison of one-digit numbers.
- Teaching the step "pawn en passant" provides a basis for imagining the typical position of that step in the mind.
- Learning to solve issues and activities with calculation processes in mind gives a foundation for tackling mathematical calculation problems.
- Solving chess problems with geometric shapes like squares and triangles.

Thus, including issues and exercises with chess pieces and the use of a chessboard into the educational process has a large potential for the development of cognitive, logical

actions, spatial thinking, and the capacity to act in the mind of elementary school students. The inclusion of the tasks developed by us in the educational process will also contribute to the formation of positive motivation for elementary school students to learn chess and mathematics.

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