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Original Article

Optimizing the Training of Chess Children with the Help of Cognitive and Tactical Tests

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Abstract

The training of chess children is characterized by specific methods and strategies adapted to their age and level of preparation. The study is based on experimental research conducted on young chess subjects. The objectives of the research are found in the validation of the means, methods and tests used, all of which have as their main goal the optimization of children's chess training. The recorded results confirm the validity of the research hypothesis, leading to the development of mental agility and increased resistance to stress of the child subjects practicing the game of chess. The conclusions of the research validate the applied scientific approach, while also offering new directions for approaching future research aimed at optimizing chess training at an early age.

1. Introduction

It is generally accepted that participating in physical activity on a regular basis facilitates a child's physical, psychological, and social development. (Tapia – Serrano, Sevil-Serrano, Sánchez-Oliva, Vaquero-Solís & Sánchez-Miguel, 2022) stated that participation in physical exercise from childhood positively influences body mass index, morphology, and competence in fundamental movement skills. (Nanu et al., 2023).

Several studies that claim that physical exercise improves academic and/or cognitive performance (Albu & Nagel, 2006) stand out. De Greeff, Bosker, Oosterlaan, Visscher and Hartman (2018) demonstrated this positive effect of physical activity on executive functions (inhibition, working memory, cognitive

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flexibility and planning) and academic performance, stating that the greatest effects are observed in interventions that perform exercise continuously, over several weeks (Rodrigo-Yanguas et al., 2023). Similar results (Roeser et al., 2022) were found by, which identified a positive effect of moderate physical activity in students on academic performance, as opposed to intense physical activity, which did not demonstrate benefits.

Additional research (Haverkamp, Wiersma, Vertessen, Van Ewijk, Oosterlaan & Hartman, 2022) showed variations from these findings, reporting that intensive exercise interventions significantly improved processing speed, inhibition, and attention, while moderate exercise interventions significantly improved processing speed, attention, cognitive flexibility, working memory, and language skills (Trinchero & Sala, 2016).

Chess games can last around 5 hours (classical chess), and a competition can take place over the course of up to 11 days with one game per day. (e.g. Chess Olympiad, European Championships) A very exciting test of chess is the "blitz", in which players have only 5 minutes per player to complete the entire game, a game that can last an average of 50 moves, some even over a hundred moves. Numerous championships, including world championships, are held in blitz format (Shymanskyi, 2025). If a 20-player blitz chess tournament were to take place in a day, each player must move the chess pieces at least a thousand times. The time constraint due to the use of the chess clock involves increasing the ability to manage time, with managing thinking within a limited range being a vital component of the game. (Nanu, Enoiu, & Teris, 2023).

2. Material and methods

Research aim, objectives and hypothesis

The use, within the training activities, of specific chess means intended to increase the mental calculation capacity of moves, therefore tactical performance, at the same time as a physical training program adapted to school age.

Objectives

Highlighting the increase in the chess tactical level of children aged 6–10 years, by streamlining the mental calculation training exercises, corroborated with the physical exercises in the training process.

Hypothesis

We assume that by using cognitive and tactical tests in the training of chess children, we will achieve the development of their mental agility as well as the optimization of their mental capacity under conditions of resistance to stress.

Research methods

1. *Kraepelin test*

This is a psychological test/means used to assess cognitive performance under conditions of resistance to mental stress.

Psychological parameters followed: flexibility of attention, speed of mental processing, adaptation to new situations, perceptual discrimination, resistance to fatigue, orientation in pregnancy, resistance to monotony.

Structure of the test and calculation procedure:

- It consists of tables with long rows of numbers, consisting of a single digit (e.g., 4, 6, 3, 9, 2).
- The subject must perform additional operations between two consecutive digits.
- Write the result of the operation between the two numbers.

The coefficient of accuracy is calculated in this way in relation to the accuracy standard in table number 1.

Cex = (Total number of good signs – Omitted) / (Total number of good + wrong signs)

Table 1. *Accuracy standard*

Class	Coefficient of accuracy
5	1,000 – 0,991
4	0,990 – 0,980
3	0,979 – 0,940
2	0,939 – 0,870
1	0,869 – 0,000

The test time totals 7 minutes, and the lower the coefficient obtained, the more the resulting parameters indicate an increased level of the desired capacities.

Also, the calculation of the resolution speed was performed, according to the formula:

VR = Time allotted/No. of total good signs

We relate this parameter due to the increased relevance in the test, as the computing capacity varies depending on the age and processing speed of the subjects.

2. The CHESS test (Tactical Chess Tests) consists of the mental calculation of a sequence of 1, 2 or more moves in advance, carried out to recognize and exploit immediate or potential opportunities and threats. The recurring patterns consisting of double attacks, bindings, discovery attacks, will force the subjects to analyze various possibilities of continuation of the game, thus improving the ability to visualize and anticipate.

The subjects were subjected to an (initial) test before the start of the experimental program and a final test after the experimental research period, in order to quantify the differences obtained.

The tests administered focused on three main themes in chess tactical procedures: face binding, double chess and chess by discovery.

For each homework, several 3 exercises with solving in one move and 2 exercises with solving in two moves were assigned. The test contains a total of 15 exercises (Figure 1).

The exercises for beginner and intermediate level have as their main theme mainly the king's mate, aiming to increase the ability to finish the game by materializing the material or positional advantage.

Each problem solved in a successfully completed move was scored with one point, respectively with two points those solved in two moves. The score is 0 for the mistake, including those in two moves where the first move was found correctly, but not the second, because it is considered that if the established purpose is not achieved, the reasoning was not correct. The work time allocated was 30 minutes, and the ChessBase 14 program was used to design the exercises.

Figure 1. *Checkmate with pawn turned into queen*

Turning the c7-pawn to c8 into queen ensures checkmate, as the bishop on e6 is tied to the rook on e2 and cannot capture the queen.

The research sample consisted of a number of 20 subjects aged between 6 and 10 years, who worked in two sports clubs in Brasov.

3. Results and Discussions

The Shapiro–Wilk normality test showed that both the initial and final scores have normal distribution, so it is correct to apply parametric tests (t-test, Cohen's d) (Table 2).

Table 2. *Shapiro–Wilk indices: TI, TF, and Pearson*

Test	Correlation / r	P-value	Normal Distribution / Significant
Shapiro–Wilk: T.I.	0.949	0.35738	YES
Shapiro–Wilk: TF	0.93	0.156	YES
Pearson correlation	0.839	0	YES

Based on the statistical calculations, there is a strong correlation of the Pearson coefficient (r = 0.839), which indicates that the subjects with good results at the beginning of the test kept high indices at the final test, and it was also found that all subjects progressed.

Analyzing the distribution of the subjects' initial and final scores obtained at the Kraepelin test (Figure 2), we find the following:

Initial scores are more widespread, with high frequency in the 0.75–0.85 range.

Final scores are more concentrated at the top (0.9–1.0), a sign that most students have progressed significantly.

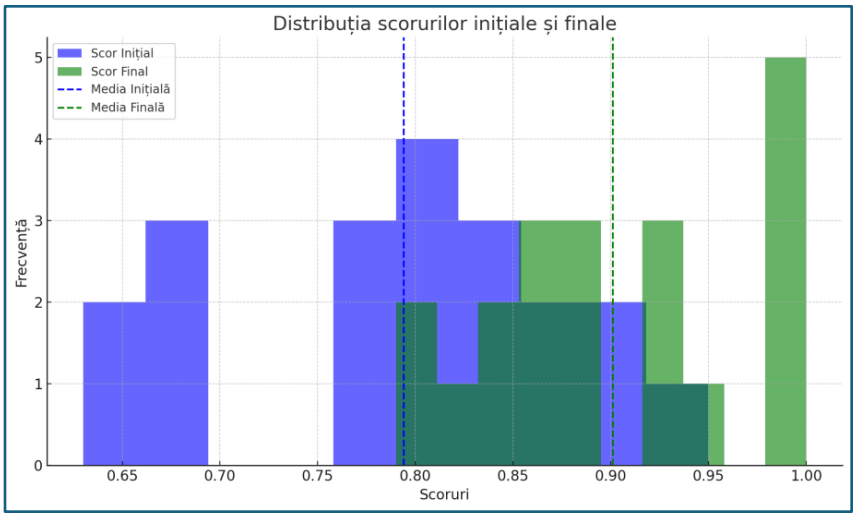

Figure 2. *Distribution of initial and final scores on the Kraepelin Test*

The shift to the right of the final average (green) from the initial average (blue) visually illustrates the effect of the implemented program.

CHESS Test (Chess Tactical Tests)

Analyzing the statistics of the results recorded in the CHESS test, we observe the increased value of the standard deviation in the case of the final test, which indicates a differentiated progress of the subjects after the application of the experimental program (Table 3).

Table 3. *Standard Deviation and Dispersion in TI and TF in the Chess Test*

Indicator	YOUR	TF	Difference
Standard deviation	2.44	2.93	+0.49
Dispersion	5.96	8.57	+2.61

Most subjects made progress of 2–4 points, with a significant group with greater progress (5–6 points).

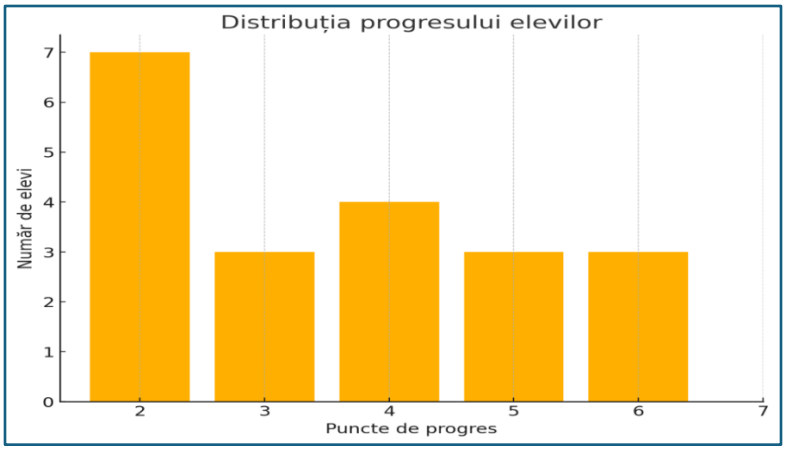

Figure 3. *Distribution of Students' Progress on the Chess Test*

A lower level of dispersion in the final test (8.57) shows that the differences between subjects increased after the experimental intervention, with the program having the effect of diversifying the results. Thus, some subjects recorded significant increases, while others progressed moderately (Figure 3).

The distribution is asymmetrical, the most common value of progress is 2 points, recorded in 7 subjects, of which 3 already had values above average at the initial test (subject 6-16 points, subject 10-18 points, subject 19-16 points).

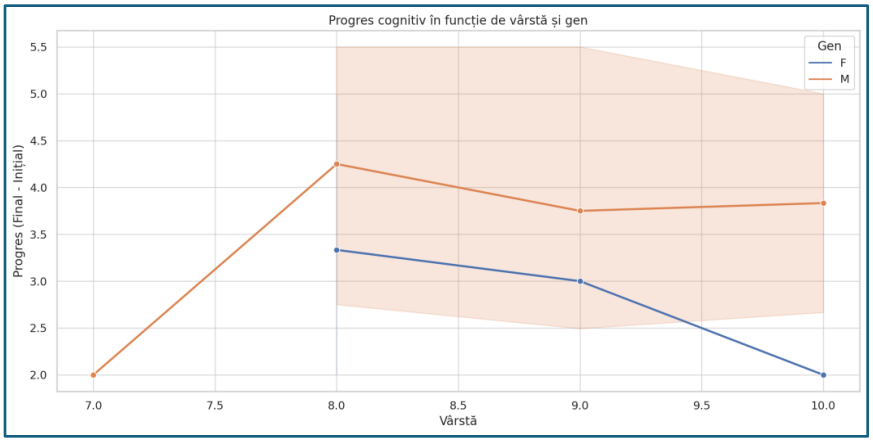

Figure 4. *Chess Test Progress by Age and Gender*

Four subjects recorded a jump of 4 points. The maximum progress was 6 points, recorded by 2 subjects aged 10 years and one aged 8 years. (Figure 4)

Discussions

Undoubtedly, playing chess requires strong problem-solving skills, and chess players demonstrate unusual memory and concentration skills. (Sweller, Clark & Kirschner, 2006) They believe that "The superiority of chess masters does not come from the fact that they have acquired general problem-solving strategies that are ingenious and sophisticated, but rather from the fact that they have stored a large number of configurations and the best moves associated with each in long-term memory".

In the current chess conditions, in which it is expected to reduce the thinking time of games in chess tournaments, for financial and advertising reasons, increasing tactical skills from an early age, such as beginner children of 6-10 years old, becomes a mandatory and fundamental goal. The ways to achieve the qualitative leap from this point of view can be done through training programs supported and organized specifically for this purpose (Șunei & Nagel, 2021).

4. Conclusions

Following the application of the scientific experiment, for the Kraepelin test we can formulate the following conclusions:

- On average, each subject was able to improve their attention and concentration by about 10.7% after applying the experimental program.
- The decrease in dispersion shows that the differences between the subjects have narrowed — they have come to be closer to each other in terms of performance, which indicates uniform learning and a reduction in the gaps between the subjects.
- The correlation of 0.839 indicates a strong link between the subjects' initial and final results. The subjects with the best results in the initial test managed to keep their superior indicators, and there was also progress of the subjects with low indices in the initial evaluation, who managed to optimize their results in this test during the final test.
- These conclusions confirm the efficiency of the experimental research carried out, which gives efficiency and inclusion to the applied experimental program.

Following the experimental research, for the CHESS test we can find that the intervention within the experimental program used had a very strong effect, with a clear and consistent improvement in the tactical chess scores of the children after the intervention. Thus:

- Most of the subjects made progress between 4 and 6 points
- The boys (M) made greater progress in all age groups.
- At age 8, boys had the highest average progress (~4.2 points).
- Girls made slower progress of about 2 points, especially at the age of 10.

These conclusions support the fact that the intervention was consistent, effective, and the results are stable at the group level.

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