

EXPERIMENTAL STUDIES OF THE ATTENTION CHARACTERISTICS OF ELEMENTARY SCHOOL STUDENTS STUDYING CHESS

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ABSTRACT

Since 2011, "chess" has been included in the Republic of Armenia's state standard of general education and is taught as an obligatory subject in grades 2-4. This breakthrough attracted the curiosity of a diverse group of scientists, particularly psychologists.

In this paper, we present the process of experimental studies conducted by psychologists of the Khachatur Abovyan ASPU's Chess Scientific Research Institute from 2013 to the present.

The study's goal is to highlight the process of demonstrating and developing attention skills when mastering and teaching the "Chess" subject.

Keywords: Chess subject, elementary school, Egoscope, attention properties.

REVIEW OF THE LITERATURE

Since 2013, the Chess Academy of Armenia and the Khachatur Abovyan Armenian State Pedagogical University's Chair of "Age-group and Pedagogical Psychology" have been conducting psychological studies, classes in schools, seminars, and discussions to identify and effectively solve problems and psychological difficulties that arise during the teaching of the subject "Chess." According to a survey of 500 teachers of the subject "Chess" in the Republic of Armenia's Lori, Shirak, Ararat, and Armavir regions, the majority of teachers emphasized the low focus of attention of elementary school students (Petrosyan, Khachatryan & Sargsyan, 2014).

Given the significance of teachers' focus on elementary school students in "Chess" classes, as well as the fact that it greatly affects students' academic progress, we have found opportunities to diagnose and enhance students' levels of concentration.

Based on the children's version of the Bourdon-Rudik (Semago & Semago, 2000) test for attention and its peculiarities, as well as the characteristics of teaching the subject "Chess," we considered it appropriate to use this test after making some minor alterations typical of a chess game.

84 students of 2nd, 3rd and 4th grades with equal distribution participated in the research. Performing the same tasks in different age groups made it possible to identify the level of concentration of elementary school students.

Following an introduction to the activity, the participants were given pictures of chess pieces in a random sequence, with the task of finding and underlining the image of the "pawn" in the same form. Figure 1 depicts 10 rows of pieces, each with 19 rows of chess pieces, for a total of 50 rows of "pawns".

Figure 1.
Bourdon-Rudik test form

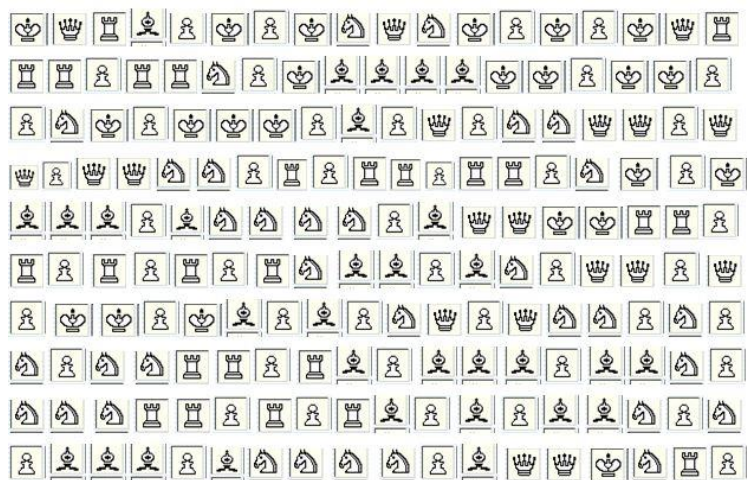


Table 1.
Quantitative analysis data of diagnostic concentration

<i>2nd grade</i>						<i>3rd grade</i>								<i>4th grade</i>							
<i>28 students</i>						<i>28 students</i>								<i>28 students</i>							
<i>The distribution of the number of subjects</i>																					
<i>4</i>	<i>4</i>	<i>4</i>	<i>4</i>	<i>8</i>	<i>4</i>	<i>4</i>	<i>8</i>	<i>4</i>	<i>4</i>	<i>8</i>	<i>3</i>	<i>3</i>	<i>3</i>	<i>3</i>	<i>3</i>	<i>3</i>	<i>3</i>	<i>4</i>	<i>3</i>		
<i>The number of erased images</i>																					

43	45	46	47	49	50	41	43	48	49	50	29	31	34	37	44	45	47	48	49
<i>The number of omitted images</i>																			
7	5	4	3	1	0	9	7	2	1	0	11	9	6	3	6	5	3	2	1
<i>Average indicator of concentration according to grades</i>																			
90,8 %						85,1%						97,9%							

The distribution of experimental data in each column shows the number of children who correctly underlined the image of the "pawn" piece, missed, or made a mistake. For example, the "4" in the first column of the first line shows that 4 children correctly underlined 43 pictures and missed 7.

Table 1 presents the experimental data of students in grades 2-4 subdivided by the classes: 1) according to the distribution of numbers, 2) missing images, and 3) successfully erased images

Experimental data were developed using the following formula for calculating the concentration factor (Karapetyan & Tsaturyan, 1983)

$$K = \frac{\Pi_1 - \Pi_2 - \Pi_3}{\Pi} \cdot 100\%$$

K is the level of concentration,

Π_1 is the total number of images of a correctly erased "pawn" piece,

Π_2 is the number of missed "pawn" piece images,

Π_3 is the number of incorrectly erased images,

Π the number of images of the "pawn" piece that must be erased in all lines.

The results show that the second to fourth graders have a high level of concentration, but it is not manifested in the mastery of the subject "Chess". Organized classes and discussions showed that the age and individual characteristics of elementary school students are often not taken into account when teaching (Petrosyan, Khachatryan & Sargsyan, 2014).

This research was the first attempt to discover the peculiarities of the manifestation and development of the features of attention during the teaching and mastering of the "Chess" subject. Surely, our research team realized that laboratory experiments and special conditions were needed to study the properties of attention in chess lessons.

In 2014, the "Egoscope" complex of objective psychological analysis and testing was purchased for this reason from the Medicom MTD Scientific-Production Company in Taganrog, Russia (Egoscope, 2014). This was a significant step forward for Armenian psychological

experimental research since, for the first time, known psychological procedures and tests would be carried out not on paper, but through a customized complex.

The "Egoscope" complex of objective psychological analysis and testing makes the application of psychophysiological methods more meaningful, at the same time showing the indicators of reaction and automatic documentation. The results of the subject's behavioral activity are recorded using a sensory tablet. The development of quantitative evaluation of research results makes it possible to reduce the subjective influence of the experimenter on the research process and the development of results. Egoscope enables (Egoscope, 2014).

Assess the psychophysiological characteristics of the subject,
in particular.

- Attention indicators
- Central nervous system activity, efficiency and ability to perform the right actions in the conditions of time deficit
- Resistance to obstacles, degree of concentration in adverse conditions
- Accuracy of response, the balance of excitation and inhibition processes

Assess cognitive qualities (logical, spatial, assessment of attention and memory indicators and patterns)

In 2014, on the initiative of the Founder-President of the Chess Academy of the Republic of Armenia, GM Smbat Lputyan, the "Chess Teaching Research Laboratory" was established, which continued its activity at the ASPU after Khachatur Abovyan. In that year, the first large-scale experimental studies were carried out by A. Khachatryan, Associate Professor of Psychological Sciences, and psychologist A. Sargsyan, using the methods of the "Egoscope" complex (Khachatryan & Sargsyan, 2014).

Based on the educational goals of the elementary school "Chess" subject standard, the Chess Teaching Research Laboratory in 2014 set research objectives and applied appropriate methods. Here we will present the research aimed at studying the properties of attention.

In the elementary school "Chess" subject standard (grades 2-4) the problem of students' attention development is singled out ("Chess" subject standard, 2012). The aim is to prove by experimental research the function of "stability of attention and obstacles" in the process of mastering the subject of Chess. Despite the existence of similar studies of elementary school students using different methods of attention, it was found that students were not segregated by academic performance. Therefore, we found it expedient to conduct a study through objective psychological analysis and testing the "Egoscope" complex among 85 students with high, medium and low academic achievements (average data in all subjects) in grades 2-4.

The "Attention and Obstacle Sustainability Assessment" methodology was used. Obstacles during the research are various visual and auditory signals - sound and color, which significantly hinder the student in the study to perform the given task (Egoscope, 2014). Each student was given 11 minutes and 30 seconds to complete the tasks. All the requirements of the methodology have been met, taking into account the age and individual characteristics of the learners. The research was conducted in 2 stages. In the first stage, the subjects were presented with 70 signals for reaction, without sound and color barriers, and in the second stage, another 70 signals with sound and color barriers.

Two main criteria were identified for the analysis of the results: *1) evaluation of attention and 2) evaluation of resistance to barriers to sound and color signals*. The following three components were used to evaluate both criteria: a) delayed, b) quick, and c) the number of accurate replies. Because both quick and delayed reactions interfere with focus and stability, and because the learner absorbs a specific amount of information during each unit of the activity, it is evident that the number of accurate reactions is given precedence in the evaluation. From the elaboration of the results of the experimental study, it turns out that the following manifestations were registered in the students of high, medium and low academic performance in the 2nd-4th grades:

According to the criterion of attention assessment

- The number of quick reactions of students with high academic performance increased by half compared to the second grade in the third grade (50%), the number of delayed reactions decreased by 47%, and the number of accurate reactions increased threefold (63%).
- The quick reactions of the students with average academic performance doubled in the 3rd grade compared to the 2nd (50%), and the delayed reactions decreased by 18%. Accurate responses increase by 12%.
- The quick reactions of the students with low academic performance in the third grade remained unchanged, the delayed reactions decreased by 16%, and the accurate reactions increased by 40%.
- The number of quick reactions of students with high academic performance in the 4th grade has decreased by 50%, delayed reactions have decreased by 24%, and accurate reactions have decreased by 24.6%.
- Quick responses of the students with average academic performance halved in 4th grade, delayed responses increased by 24%, and Accurate responses increased by 20%.

- The quick reactions of the students with low academic performance in the 4th grade increased by 46%, the delayed reactions decrease by 46%, and the accurate reactions increase by 40%.

According to the criterion of resistance to obstacles.

- The number of rapid reactions of students with high academic performance in the 3rd grade increased by 25%, delayed reactions decreased by 33%, and accurate reactions decreased by 8%.
- The quick reactions of 3rd graders with average academic performance decreased by 42%. Delayed reactions increased by 9%, and accurate reactions increased by 7%.
- The quick reactions of the students with low academic performance in 3rd grade decreased by 10%, delayed reactions decreased by 8%, and accurate reactions increased by 36%.
- The number of quick reactions of students with high academic performance in the 4th grade increased by 20%, delayed reactions increased by 3%, and Accurate reactions decreased by 8%.
- In the 4th grade the students with average academic performance, quick responses decreased by 29%, delayed responses decreased by 19%, and accurate responses increased by 45%.
- The rapid reactions of the students with low academic performance increased by 10% in the 4th, the delayed reactions decreased by 22%, and the accurate reactions increased by 44%.

It is believed that the study of the subject of Chess in elementary school helps to increase the stability of students' attention. This is evidenced by the fact that while completing the given tasks, students try to increase the number of accurate reactions by quickly responding to the obstacles presented to them, thus increasing the concentration of attention. Thus, learners focus and maintain their attention for a long time to find a way to solve the given problem, which in our opinion contributes to the development and improvement of other mental processes, as well as to the increase of educational progress (Karapetyan, Khachatryan & Sargsyan, 2015).

To determine the speed of students' attention transfer and distribution in grades 2-4, we conducted the "Schulte-Platonov red-black tables" methodology in the above-mentioned research group (Egoscope, 2014). The following instructions were given to the subjects in each successive phase.

Phase 1: You will see black and red numbers in the boxes. It is necessary to mark the black numbers, arranging them from the smallest to the largest, ie from 1 to 13.

Phase 2: You will now see black and red numbers in the boxes. You need to mark the red numbers, sorting them from largest to smallest, that is, from 12 to 1.

Phase 3: You will now see black and red numbers in the boxes. You will first mark the smallest of the black numbers, that is 1. Then you will mark the largest of the red numbers, that is 12, after which you will have to mark the next 1 of the black numbers again, that is, 2, and then you will go to the red numbers again, marking the previous of 12, that is 11. And so you have to sort the black numbers from the smallest to the largest and the red ones from the largest to the smallest.

The results obtained in the "Egoscope" complex were analyzed according to the following components of attention: a) volume, b) distribution, c) mobility, d) infallibility and e) integral efficiency levels.

Table 2.

Analysis of the results of the "Schulte-Platonov red-tables" methodology.

Component Name	2 nd grade			3 rd grade			4 th grade		
	The academic progress of the subjects								
	High	Avera ge	Low	High	Avera ge	Low	High	Avera ge	Low
Level of the attention volume	avera ge	above avera ge	avera ge	avera ge	high	above avera ge	above average	above avera ge	avera ge
Level of the attention distribution	below avera ge	above avera ge	avera ge	avera ge	above avera ge	above avera ge	above average	above avera ge	avera ge
Level of attention mobility	avera ge	above avera ge	above avera ge	avera ge	above avera ge	high	above average	above avera ge	High
The level of infallibility attention	low	above avera ge	low	below avera ge	below avera ge	low	high	above avera ge	above avera ge

The analysis of the results reveals that the level of attention, distribution, mobility and especially the infallibility of elementary school students mastering the subject of "Chess" goes from low to high in grades 2-4 (Sargsyan, 2016).

To find out the current level of manifestations of the psychological components of the "Chess" subject taught in elementary grades, in 2015-2016, the research group of psychologists of the Chess Educational Research Center of the Khachatur Abovyan Armenian State Pedagogical University conducted experimental studies. Below we present the research goals, problems of the experiment, the methods used following them, and the analysis of the obtained results.

The diagnostic experiment was carried out in the 4th, 5th, and 6th grades of Yerevan John Kirakosyan N20, Vahan Teryan N60, and Vagharshapat Khachatur Abovyan N4 basic schools with a total number of 135 students. Two research issues have been raised:

1. To record the coordination of the movements of the 4th and 5th graders who studied the subject "Chess" in the elementary grades and their capacity to adjust in the conditions of time deficit and compare the "Chess" topic with the same indicators of the 6th graders who did not study at school.

The "Trajectory 3" methodology was selected and applied from the "Egoscope" complex of psychological analysis and testing, which is designed to assess the coordination of the subject's movements in the conditions of time deficit and their ability to adjust. During the task, the subject should be able to follow the red light moving along the trajectory, keeping the tip of the electronic pen at a certain distance from the touch screen (not more than 18 mm away from the screen).

AVERAGE RESULTS OF "TRAJECTORY3" METHODOLOGY							
<i>Criterion name</i>		4th grade Studied Chess for 2 years		5th grade Completed chess studies		6th grade Chess has not been studied	
		<i>Right hand</i>	<i>Left hand</i>	<i>Right hand</i>	<i>Left hand</i>	<i>Right hand</i>	<i>Left hand</i>
1	Total number of errors, pcs	64	60	78	74	66	63
2	Experiment time, sec.	30	30	29	30	30	30

The analysis of the results of the "Trajectory 3" method shows that the total number of mistakes made by the 4th-grade students who studied Chess for 2 years at school is 14 less than in

the 5th grade, ie the same number of students who completed the Chess course. As for the number of students who did not study Chess at all in the 6th grade, their total number of mistakes is 12 less than the same number of 5th graders.

An interesting fact was recorded that for all 3 groups of subjects the time of the experiment remained unchanged - 30 seconds. An interesting fact was recorded that for all 3 groups of subjects the time of the experiment remained unchanged - 30 seconds. From this, we conclude that the coordination of movements and the level of their ability to regulate their willpower in the conditions of time deficit is more pronounced, especially in the 5th-grade students.

2. The second task of the diagnostic experiment is to identify the current level of speed and fatigue of 4th and 5th graders who have studied Chess in elementary school and compare it with the same performance of 6th graders who did not study Chess at school.

Two methods were selected and applied from the "Egoscope" complex of psychological psychological analysis and testing: "Simple visual-motor echoes" and "Complex visual-visual echoes". The examination was performed with the help of a visual tube or "**Tubus**". It is connected to the computer that supports the operation of the "Egoscope" complex. In the case of simple visual responses, we suggest that the subject press the black button at the top of the tube immediately after seeing the green light inside. In the case of complex visual reactions, the subject is given the same instruction, except that in addition to the green light inside the tube, there is also a red light. In case of noticing it, it is required to wait until the green light turns on.

AVERAGE DATA OF "SIMPLE AND COMPLEX VISUAL-MOTOR REACTIONS " METHODOLOGIES						
Name of the parameter	4th grade Studied Chess for 2 years		5th grade Graduated from Chess Study		6th grade Not studied chess	
	Right eye	Left eye	Right eye	Left eye	Right eye	Left eye

1	Number of delays, pcs	2	2	1	1	3	3
2	Number of quick reactions	6	6	3	3	5	5
3	The exact number of reactions	22	22	26	26	22	22
4	Speed	Medium		high		below average	

The results of the "simple and complex visual-motor reactions" methods were analyzed according to the following criteria: late, early, accurate reactions, and speed.

The results show that the number and speed of accurate reactions of students who completed the study of the subject "Chess" in the 5th grade, ie in the 4th grade who studied the subject "Chess" for 2 years and in the 6th grade who did not study the subject "Chess" at all, are the same indicator of learners. We infer that the decision-making speed and tiredness detection rates of 5th students are much greater than those of 6th graders who did not learn Chess at school.(Sargsyan A., Khachatryan A., Lputyan G, 2016):

We also touched upon the study of the attention features of elementary school students studying chess in 2018 already part of the "Chess" research institute operating at the ASPU.

At present, there are no experimental data concerning the stability and effectiveness of learners' attention during teaching and mastering of chess discipline. That is why our research team has set a goal to identify the relationship between the attention efficiency and stability of the junior schoolchildren studying "Chess" discipline.

Since 2018, the psychologists' research group of "Chess" scientific research institute has conducted experimental studies at the school of Kh. Abovyan ASPU. The experiment involved 30 schoolchildren with high, medium, and low academic progress in the 2nd and 3rd grades. The study was conducted in two stages.

Selection of appropriate methodology from "Egoscope" psychological objective analysis and testing complex, pilot application to discover learners' attention effectiveness and stability level (Egoscope, 2013, pp. 56-62, 70-74).

1. Analysis of the study results.

The method of "Find and underline" has been selected and applied from "Egoscope" psychological objective analyses and testing complex following the relevant research objective (Martsinkovskaya, 2000).

The performance effectiveness of the tasks has been determined by the following criteria: the number of correct, incorrectly highlighted and missed objects (pcs).

The study data results analyses are presented below in a diagram.

Diagram 1.

2nd grade. Analyses of "Find and underline" methodology application results.

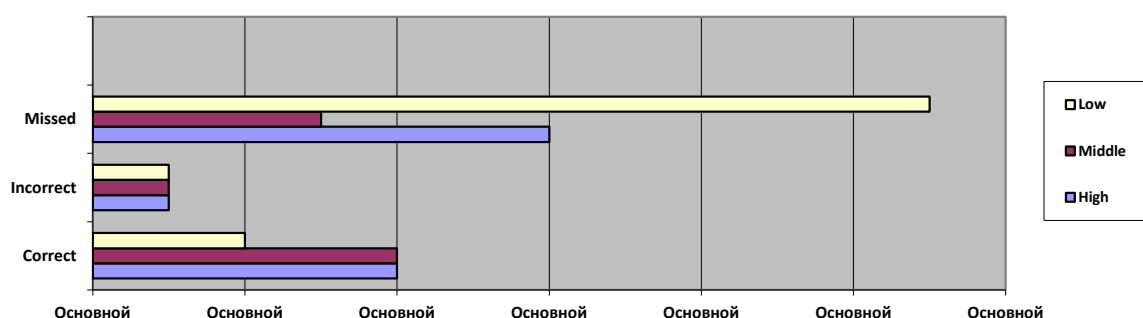
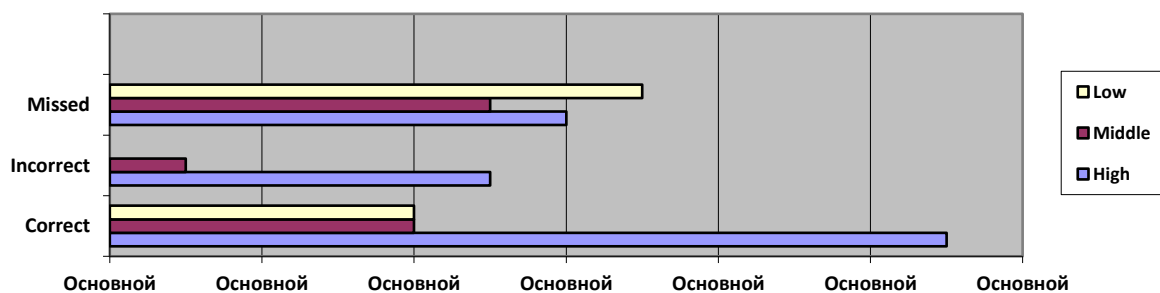


Diagram 2. 3rd grade

Analyses of "Find and underline" methodology application results.



Quantitative analyses of the "Find and underline" methodology application results clarify that in the case of "Chess" discipline teaching and mastering positive progress was observed in the 3rd-grade low-progress schoolchildren in comparison with the 2nd-grade, as the number of correct objects has increased and the number of incorrectly underlined and missed objects have been decreased (pcs).

One of our research tasks is to identify significant positive connections between the attention efficiency and stability of the chess studying second and third-grade schoolchildren. Collected data

were analyzed by a statistical method, more precisely, by Pearson's correlation formula for ranking. There was found a strong correlation between the effectiveness and stability of attention ($r = 0,9$, $p = 0,000$). There was no significant positive correlation between attention concentration and learners' achievements among the chess studying second and third-grade schoolchildren.

We can conclude that the effectiveness of the teacher-organized work aimed at developing the attention features in the teaching of chess does not depend on the schoolchildren's academic progress (Khachatryan, Sargsyan & Lputyan, 2019).

FOLLOW-UP AND CONCLUSION

The results reveal that the subjects concentrate and sustain their attention for a long period to discover a solution to the provided challenge, which leads to educational advancement.

Thus, the study of the subject of Chess in elementary school contributes to the stability, attention, volume, distribution, mobility, and most importantly, the degree of the infallibility of their attention.

We conclude that the efficacy of teaching and mastering the subject of chess is generally influenced by the development of elementary school students' key aspects of attention, which influence their cognitive sphere.

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