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STUDY REGARDING THE DEVELOPMENT OF MEMORY AND THINKING IN CHILDREN USING THE GAME OF CHESS

C.NANU[1] R.S.ENOIU[1] Ş.TERIŞ[1]

Abstract: *The development of memory and thinking in children who practice chess is very important for their access to performance. In this study we focused on the application of standardized tests to observe whether playing chess in an organized matter will develop thinking faster than children who do not practice this sport. Also, the visual memory of young school children can be improved by chess, as it becomes superior to those of the same age who do not play chess.*

Key words: *chess, tests, memory, thinking.*

1. Introduction

„The concept of memory refers to the functional relationships existing between two groups of observable behaviours separated by a range of varying duration [...], the first behaviours belonging to the acquisition phase [...], subsequent behaviours belonging to the actualization phase [1].

Memory is a cognitive psychic process consisting in imprinting (learning), recognizing, retaining and updating (by recognizing and reproducing) previous experience (cognitive, affective, voluntary). It defines the temporary dimension of our psychic organization, its integration into the three segments of the temporary horizon, namely past, present and future [9]. Memory is considered the basis of the psychic life of personality, because without memory, man would cease to orient himself in the environment, becoming an automaton that acts primitively every time. Through its involvement, the development of the being is ensured through accumulation, coherence and continuity of psychic life on the axis of time [11]. Secenov considers memory the „cornerstone" of psychic development, "a fundamental condition of psychic life" and U. Şchiopu considers memory a "backbone of personality", due to its role in the continuation of identity. Memory is the logical cognitive process that reflects the world and man's relations with the world by imprinting, preserving and updating (by recognizing and reproducing) previous experience (cognitive, affective, voluntary) [2].

Memory is a process of selective, situational, relatively faithful, active and intelligible reflection of previous experience. It is in close interdependence and interaction with the rest of the psychic processes and activities [10]. A

[1] Department of Motor Performance, Transylvania University of Brasov, Romania

relevant example for this situation is the ratio of memory and imagination. These two cognitive processes are conceptualized as often opposite processes [8]. This is because memory is associated with accessing information from the past, and imagination is oriented towards the future. Despite being correlated as opposite processes, there are very close functional links between the two and they cannot function one in the absence of the other [3].

There are three main forms of manifestation of human memory:

- *Sensory memory*

Sensory memory or sensory information register (RIS) is a type of short-term and very short-term memory that has the role of activating for a few seconds and overlapping with the concept of aftereffect, as sensory reminiscence. The essential function of this type of memory is to preserve sensory information until other cognitive processes intervene capable of retrieving, analyzing, interpreting and making sense of it. Sensory memory expresses the fact of maintaining the "continuity" of information flow within the systems of analyzers a sufficient time for: encoding-recoding, processing and interpretation. In the end, the result must be the elaboration of the nervous model of the stimulus and, based on this, the "image-code".

- *Short-term memory (STM)*

Short-term memory is a complex and heterogeneous organization from an informational point of view and aims to retain information only for a small period, the maximum limit being estimated at 8-10 minutes. What happens to the information after this interval? Either it is "lost", that is, forgotten, or it passes into long-term memory. This depends on the presence or absence of disturbances along the persistence interval of short-term memory. The volume of STM in units of informational "material" is, however, quite small, expressed in G. Miller's "magic number" 7+\- 2. It corresponds to the extent of the area of concentration of attention: we cannot fix and distribute attention optimally at the same moment on more than 5-6 elements (objects). To make room for other „data" or informational elements, it is necessary that those that make up the current volume of STM be "pushed" aside: either into the fog of oblivion or into the stable reservoir of STM. Receiving STM content „on the fly" in accordance with the actual course of events requires an extremely flexible coding mechanism. In the structure of the CNS, another more adequate to this requirement than the bioelectric potential is unknown. And if there are still discussions regarding STM support, regarding STM the unanimous opinion is that it is essentially bioelectric [4], [5].

- *Long – term memory (LTM)*

Long-term memory has the role of preserving information for a considerable period of time that can stretch throughout life. This type of memory represents the totality of informational and operational structures whose lower retention limit in time is equal to at least the maximum limit of MSD according to the following coordinates: time, degree of activation, volume, fastening mechanism. [5]

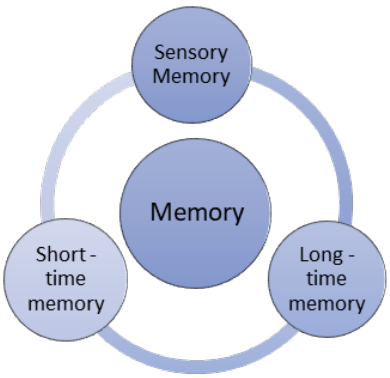

Fig. 1. *Forms of manifestation of memory*

Also, repetition is a key factor in developing memory. There are two methods of repeating, namely, the fragmentary method and the global method. The fragmentary method consists of rendering certain pieces into small fragments [14]. There are situations in which readings and repetitions are made with the piece to be learned and are done on very small fragments, and thus only the first sentences are read, they are reread, and the effort intervenes to repeat them without looking at the content, constantly returning to them until there is conviction that they are known [12]. The overall method consists of reading the piece in its entirety, from end to end, and seeking to be remembered as a whole [13]. After one or more global readings, an attempt is made at repetition, then one returns to reading, and, without concern for repairing the forgetfulness that is observed by repeating from memory, a global reading is made again and again, that is, of the whole piece from one end to the other. This method is contrary to human instinct; People are not used to resorting to this method because it is over their hand because it requires more attention than the other [6], [7].

2. Methods used in Research

The research hypothesis is that if the young schoolchild practices chess in an organized way, then thinking develops faster and at a higher level compared to non-chess subjects of the same age. Also, the memory of the young schoolchild can be improved through chess, becoming superior to those of the same age who do not play chess.

For this study were used two groups: the experimental group consisting of subjects that play chess and the control group consisting of subjects that do not play chess.

The experimental group consisted of 19 chess players, they have been playing chess for 1 year in an organized setting, their selection being made by lottery. Thus, the names of all those who have been playing chess for 1 year and are in classes I-IV were written on the cards. The selected chess players are members of a chess club in Brasov.

The control group also consists of 19 subjects. The selection of the subjects was made by lottery: the names of all those in first class who could write were written on the cards, and 4 cards were extracted. In the same way, the selection of those in classes II-IV was also made, this time 5 cards were chosen. All the subjects are students at a general school in Brasov.

Two tests - initial and final - were performed on both the children who play chess and those who do not play chess. The initial test was conducted on 02 October 2022 for the subjects that don't play chess at 12 noon, and for the subjects that play chess s on 03 October 2022 at 12 noon.

Final testing was also conducted at 12 noon on March 29, 2023 and for the subjects that play chess on March 30, 2013 at 12 noon.

In this study there were used three tests:

- *For memory:*

Lalaume test composed of 2 sheets (A and B) printed on one side only. On sheet A is drawn a square with 16 equal divisions. In each division is printed a certain figure. On sheet B is printed the same pattern with 16 divisions, but empty, and in them the subject draws, from memory, the figures he remembers.

- *For thinking:*

W.I.S.C test

The Wechsler Trilogy comprises 3 scales:

- WPPSI (Wechsler preparatory

intelligence scale - for preschoolers),

- WISC (Wechsler intelligence for children - for children over 6 years) and
- WAIS (Wechsler adults' intelligence scale - for adults).

There is no fine boundary between the three instruments, but areas of overlap. The Wechsler scales have demonstrated a superior degree of validity and are widely used in current examinations. An important quality of the Wechsler scales lies in the possibility of studying the development of intellectual skills on a continuous basis, from preschoolers (W. P.P.P.S.I.) to schoolchildren (W.I.S.C.) and adults (W.A.I.S.). The same tests are used for all age groups, with differences resulting from the composition of items with a progressive degree of accessibility. For children, in our country, a scale has been adapted from the W.I.S.C.- R (W.I.S.C. - revised, French version) with wide application in examining the mental level at school age.

The WISC consists of two subscales: the verbal scale and the performance scale.

The subtests for the verbal scale are: 1. information; 2. similarities; 3. arithmetic; 4. vocabulary; 5. comprehension. There is also a test of memory of figures (complementary test, supplementary test). The performance subscale includes: 1. completing the image; 2. coding; 3. arranging the image; 4. cubes;5. assembling the object. The maze test (additional test) and the symbol search (optional test, for clues, for substitution) are also performed.

The 10 tests are considered "basic" and the 3 tests (digit memory, maze test and symbol search) are „alternative tests" listed in the tables in brackets. The tests measure different abilities, which are combined into an overall score (quantity and quality of information stored by long term memory, information test; generalization ability - Similarities test; anticipatory programming - Cubes test etc.).

- *Goodenough Test:*

Drawing the man, where the child is asked to carefully draw a picture of a man. Scoring: One point is awarded for each of the 50 items (presence of neck, costume present, head-trunk proportion, eye details, two-dimensional representation of arms and legs, clearly represented forehead and chin, etc.) present in the drawing and the total is added up and compared with the age norm.

Table 1

Comparison of Goodenough test performance in chess playing subjects versus non-chess playing subjects using arithmetic mean

Parameter	**Non playing chess subjects**	**Chess playing subjects**
Initial testing	22,631	24,473
Final testing	23,105	25,631
Evolution–numerical	0,474	1,158
Evolution–percentual	2,09%	4,73%

In table number 1, at the Goodenough test, the subjects who do not play chess have an evolution of 2.09% at the final testing, while the subjects who play chess have an evolution of 4.73% at the final testing. The progress of the experimental group is better with 2.64% than the control group.

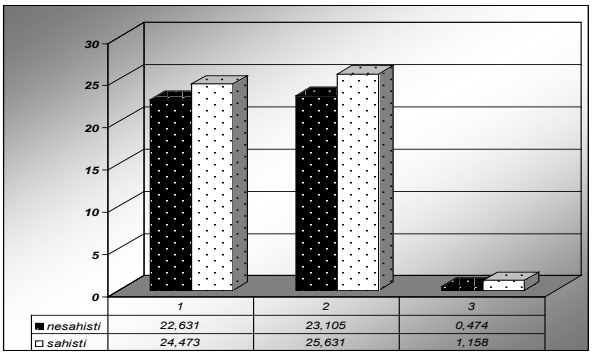

Fig. 2. *Comparison of Goodenough test performance in chess subjects versus non-chess subjects using arithmetic mean*

In figure number 2 at the initial testing the control group have scored an average of 22,631 points and at the final testing scored an average of 23,105 points. The recorded progress for this group was 0,474 point.

In the same figure the average scored by the experimental group at the initial testing was 24,473 points while at the final testing, the same group scored an average of 25,631 points. The progress recorded for the experimental group was 1,158 points.

Based on this figure we can assume that the experimental group has a progress with 0,684 points bigger than the control group.

Verification of research hypotheses. The t-Student test was used to check whether the evolution of chess subjects' results in the Lalaume and W.I.S.C. tests is due to chance as stated in the null hypothesis or due to organized chess practice as stated in the research hypothesis. The tabular value of t is 2.110 for $p<0.05$ and 2.898 for $p<0.01$.

The values of t calculated using the formula: t=Đ¬/SĐ (where Đ is the mean of the differences and SĐ is the standard deviation of the mean) for the Lalaume and W.I.S.C. tests are given in the following table:

Student's t-test values for the Lalaume, W.I.S.C. and Goodenough tests Table 2

Test	**Non playing chess subjects**	**Chess playing subjects**
Lalaume	0,77	2,94
WISC	1,74	5,04
Goodenough	1,04	3,882

The t-values for the chess subjects are higher than the tabulated values for $p<0.05$ and $p<0.01$. This allows us to state the following: the correlation coefficient is significant; the research hypothesis is validated for both significance thresholds; the generalization of the data can be performed. It can also be noted from the table that for the subjects who do not play chess the t-values are lower than the tabulated values for $p<0.05$ and $p<0.01$ and therefore the increase is insignificant.

As a result of the above, the null hypothesis is rejected and the research hypothesis is validated. In this case, practicing chess in an organized way contributes significantly to the increase of memory and thinking.

3. Conclusions

In summary, the benefits of chess can be recognized in all aspects of education: Chess develops mental skills used throughout life: concentration, critical thinking, abstract reasoning, problem solving, recognition of logical patterns, strategic planning, creativity, analysis, synthesis and evaluation. Chess can be used effectively as a tool for teaching problem solving and abstract thinking; learning to solve a problem is much more important than learning solutions to particular problems. Through chess, one learns to focus on what is important and eliminate what is distracting; one learns to find creative solutions, make plans and implement them. The game of chess involves several skills and has various psycho-pedagogical benefits:

- increases IQ;
- develops problem-solving skills, teaching students to make difficult and abstract decisions independently;
- provides practical opportunities to make quick and correct decisions under time pressure, a skill that can improve performance in school exams;
- develops memory, reading, language and mathematical skills;
- develops critical, creative and original thinking.

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