Bulletin of the*Transilvania* University of Braşov
Series IX: Sciences of Human Kinetics • Vol. No. 2 – 2021
https://doi.org/10.31926/but.shk.2021.14.63.2.26

STUDY ON THE CORRELATION BETWEEN SPATIAL ORIENTATION AND LOGICAL THINKING IN STUDENTS WHO STUDY CHESS IN SCHOOL

V.I. STEGARIU [1] G.S. IACOB[1]

Abstract: *The role of thinking in practicing chess is obvious because the game is a mental struggle between two opponents, and weapons are the notions previously assimilated. Their operationalization is present both in the training sessions prior to the competition and during the matches. 32 4th grade students were selected and divided equally into two sides, the experimental group and the control group. The Bender-Santucci test (spatial orientation) and the Similarities Test (logical thinking) were used to observe both intellectual and physiological development. The experimental group recorded better marks in both tests, and these results correlate statistically.*

Key words: *chess, spatial orientation, logical thinking, children.*

1. Introduction

The popularity of chess is steadily increasing due to the pandemic situation. It is well known that the most important part of an activity is the accessibility. Over the board chess was put on halt because of safety reasons and was forced to move into a new domain. The first national lockdown (March 2020) meant that the majority of population changed their normal activities and most of their time was in front of the screen.

Compared to other sports, the practice of chess in not limited by the physical presence of the players; on the contrary, it can be played in better conditions with the help of a computer. The obligation to spend time in front of the computer synchronized with the appearance of the TV mini-series „The queen's gambit" which produced a general interest towards chess.

Chess players showed an improvement in both meta-cognitive and math problem-solving skills compared to pupils who did not practice chess [3]. Playing chess develops the ability to use critical thinking in chess related situations but also in real life tasks. The few personality studies among chess players showed an increased score at introversion tests [4] and a higher intensity in thinking process [1]. When specific memory was observed, pattern recognition correlated with the strength of the players and the general thinking process [5]. Judging by the higher score registered by the chess players [11] we

[1] *Alexandru Ioan Cuza"* University of Iaşi, Faculty of Physical Education and Sports

can assume that the development of the thinking process extends also outside the chess world.

Most of the studies dedicated to the effects of playing chess have been aimed at discovering the link between chess and children's academic development. Scholastic chess instruction uses chess as an alternative tool to work on cognitive and academic skills. Those skills, logical and spatial thinking, reasoning and long-term planning, play a huge part in their development [7]. Although most of these studies were advocated by chess people this does not mean that they should be disregarded and just by observing the evolution of children who play professionally, we can grasp the meaning of this process [8]. There is another side of why playing chess fits the nowadays needs and that is because in every child's education process a disciplinary activity should find a way in. This generation loves to play games so studying chess will improve their critical thinking [12] [13].

Playing a game which helps the individual to enrich their intelligent and strategic thinking will result in an improved self-esteem [9].

Due to the fact that children are competitive and the nature of chess implies imagining potential moves and representing future developments, a deep-thinking mechanism will be created [2].

The main change in the child's life that influences decisively the perception of temporality is the transition to school life. The delimitation and timing of activities help the children to integrate in the environment [6] which will result in an improved mechanism for gathering the new information.

Overall intelligence is reckoned as a sign of a qualitative development and playing chess improves it [10].

2. Material and Method

The purpose of the research is to observe the level of correlation between the spatial orientation and analytical thinking in children from primary school.

We tested a group of 32 4th graders from a public school in Iași county, Romania who participated in a weekly chess lesson. They have 10 or 11 years and the age mean is identical 10.69. The experimental group studied in the same school since the first grade where they followed methodically the learning and consolidation process accordingly to their needs.

The children completed two tests: „Similarities" (analytical thinking) and „Bender-Santucci" (spatial orientation).

First test aims to highlight the subject's ability to discover the essential and common features of two objects. Using a classification method in solving the items, as required by the nature of the test, implies a flexibility of thinking which is not negligible in every intellectual activity. The Similarities test, as with most verbal tests, is conditioned to some extent by socio-cultural factors. A couple of items can be solved easily due to children's experience and this can be an inconvenience if the learning conditions were different. To compensate this, the test includes items that no longer appeal to knowledge previously learned and involve a greater degree of depth.

The Bender-Santucci test observes the spatial orientation function, which can be described as an ability to perceive with accuracy a spatial configuration, to compare them with each other, to render

space and shape and to recall the form that can serve as the content of various mental operations. The child should not be limited, it can be timed, but the duration does not affect the overall result. By registering the duration of each drawing results in observing the rhythm of work. If the child is not satisfied and asks for a new sheet of paper, he is given, but only the first drawing is counted. Also, if he decides to abandon the first attempt and starts drawing again, then the last one is recorded.

3. Results

Following the application of the evaluation protocol, the children obtained the statistically synthesized results that are shown in the table below.

Table 1

Statistical results

	Mean	Std. Dev.	Variance
Similarities Exp	18.19	2.810	7.90%
Bender-SantucciExp	33.63	6.174	38.12%
Similarities Con	14.94	4.837	23.40%
Bender- Santucci Con	27.75	4.865	23.67%

We can see that the experimental group registered better results in both tests. The high value of variance in Bender-Santucci test is due to the fact that some children managed to register impressive results. The comparison of values with the standard ones presents an encouraging reality. The experimental group obtained a result that fits in a higher category (Bender-Santucci), 12 years, and the other one fits in the tests first category (Similarities). On the other side, the control group registered 2 results that are lower than those estimated for their age, not by much, but enough to notice a clear difference between the groups.

Table 2

Independent-Samples t-test

	Similarities	Bender Santucci
Levene's test for Equality of Variances		
F	1.147	0.364
Sig.	0.293	0.551
T	2.324	2.990
df	30	30
Sig. (2 tailed)	0.027	0.006
Mean difference	3.250	5.875
Std. Error Difference	1.398	1.965

The Independent-Samples t-test had been used to point out the fact that the differences between the results are statistically different.

Table 3

Pearson Corelations-Exp. Group

		Simi-larities	Bender Santucci
Similari-ties	Pearson	1	0.135
	Sig. (2 tailed)		**0.618**
	N	16	16
Bender-Santucci	Pearson	0.135	1
	Sig. (2-tailed)	**0.618**	
	N	16	16

As it can be seen there is a moderate to strong correlation between the 2 tests taken by the experimental group. One explanation for this is the very good result recorded by 2 children in the Bender-Santucci test. This positively affects the average result of the whole group.

Table 4

Pearson Corelations-Con. Group

		Similari-ties	Bender Santucci
Similari-ties	Pearson	1	0.101
	Sig. (2-tailed)		**0.709**
	N	16	16
Bender-Santucci	Pearson	0.101	1
	Sig. (2-tailed)	**0.709**	
	N	16	16

The control group registered an almost strong correlation between the 2 results. Because both of them were under the average, according to their age, the level of correlation is justified. Also, when it comes to observe spatial orientation with Bender-Santucci, it is recommended to verify the result with an intellectual test, such as Similarities.

4. Discussions

The results presented above outline a correlation between the spatial orientation and analytical thinking in children from primary schools who study chess. Somehow this correlation isn't the focal point of any recent study regarding the role of chess in child's development. This is strange due to the fact that the game itself requires some hand and eye coordination for moving the pieces from a well defined small sized square to another. Many training games are played under severe time pressure which develop this ability even more. Besides this practical aspect, during a chess game each player is forced to observe if a part of the board is exposed and can be exploited by the opponent. Specific spatial orientation is the key for many tactical ideas such as: clearing a line, exploiting the last rank, clearing a square etc. In order to become a strong player, the development of this skill is mandatory. Also, at a lower level, understanding the difference between the bishop and the rook also requires some spatial understanding of the board. Put in the middle of the board, the range of this pieces are similar and the only difference is that the bishop moves only on one colour. Knowing and being able to exploit this aspect helps the development as a chess player. Also, judging by the way the pieces move they can be linear or may have different rules.

Observing these aspects of the game and knowing how important spatiality in the children's growth is, I've decided to identify how and if chess classes can help improving this ability.

A statistical difference between the means of the groups was registered at both tests (table 2). One of the most important steps of this research was to find out if the results registered by the groups show a clear difference. As it can be seen in table 2, an independent-samples t test, indicates that the values of both tests are statistically different. Another indication of the same conclusion is the fact that the recorded results fit in different tests categories.

Using the Pearson correlation with two variables (tables 3 and 4), the link between the Similarities and the Bender-Santucci test was discovered being moderate to strong in both groups. Adding these two findings, statistically better results for the experimental groups in both tests and a moderate to strong correlation in between the tests in both groups, we can state that studying chess once a week leads to a better growth.

The children from the experimental group had studied chess since the first

grade until the fourth as an optional subject and this means that they did not have an extra activity. The control group had different activities each year such as: a second language (French), physical education, mathematics and children's literature. Not having a constant optional subject meant that most of the knowledge acquired during that year was not backed up directly. Although it broadens the child's perspective, the activity can be classified as superficial but this aspect should become the focal point of a different research.

Further research with an increased number of participants is required. Another aspect that can be modified is the duration of chess instruction. In this case, the experimental group had 4 straight years of chess instruction, but some school offer this subject only for a specific year. Another research needs to be done when the chess classes last only for a semester or for one year.

5. Conclusions

Chess instruction leads to a better development for children from primary school.

There is a correlation between spatial orientation and analytical thinking when it comes to children who study chess weekly.

The relatively small number of subjects represents a research limit which should be addressed in future projects.

The intellectual aspect of this game is slowly, but steadily, shifting to a more complex one which involves also the pscyho-motor development of children.

The time frame, research design and the number of subjects remain the main factors in validating the findings.

References

1. Alifirov, A.I., et al.: *Methods of training chess players of higher sportsmanship*. In: Dusunen Adam. 10, 2019, p. 45-51.
2. Bilalic, M., McLeod, P., Gobet, F.: *Does chess need intelligence? — A study with young chess players.* In: Intelligence, 2007, 35, p. 457-470. 10.1016/j.intell.2006.09.05.
3. Kazemi, F., Yektayar, M., Abad, A.: *Investigation the impact of chess plays on developing meta-cognitive ability and math problem-solving power of students at different levels of education*. In: Procedia - Social and Behavioral Sciences, 2012, p. 372-379. 10.1016/ j.sbspro.2012.01.056.
4. Klein-Vollstädt, S., Grimm, O., Kirsch, P., Bilalic, M.: *Personality of Elite Male and Female Chess Players and its Relation to Chess Skill*. In: Learning and Individual Differences, 2010, 20, p. 517-521. 10.1016/j.lindif. 2010.04.005.
5. Mihailov, E., Savulescu, J.: *Social Policy and Cognitive Enhancement: Lessons from Chess.* In: Neuroethics, 2018, 11. 10.1007/s12152-018-9354-y.
6. Murias, K., Slone, E., Tariq, S., Iaria, G.: *Development of spatial orientation skills: an fMRI study*. In: Brain Imaging and Behavior, 2019, 13. 10.1007/s11682-018-0028-5.
7. Nicotera, A., Stuit, D.: (2014). *Literature Review of Chess Studies* https://saintlouischessclub.org/sites/default/files/CCSCSL%20Literature%20Review%20of%20Chess%20Studies%20-%20November%202014.pdf
8. Poston, D., Vandenkieboom, K.: *The Effect of Chess on Standardized Test Score Gains*. In: SAGE Open, 2019, 9.

215824401987078.10.1177/2158244019870787.

9. Sigirtmac, A.: *An investigation on the effectiveness of chess training on creativity and theory of mind development at early childhood*. In: Educational Research and Reviews, 2016, 11, p. 1056-1063. 10.5897/ERR2016.2676.
10. Stegariu, V.I., Popusoi, S., Abalașei, B., Voinea, N.L., Stelescu, I., Trofin, F., Honceriu, C.: *The Role of Chess in the Intellectual Development of Children from Primary School.* In: SPORT AND SOCIETY, 2019, p. 58-62. 10.36836/UAIC/FEFS/10.56.
11. Stegariu, V.I., Vornicu, M.: *The benefits of Chess Practice on Students – A Meta-Analysis*. In: PROCEEDINGS OF THE 6 th International Conference of Universitaria Consortium "FEFSTIM: Physical Education, Sports and Kinesiotherapy – implications in quality of life", 2020.
12. Stegariu, V.I., Iacob, G., S.: *The effects of practicing chess on analytical thinking in primary school students*. In: SPORT AND SOCIETY, 20, 2020, 10.36836/2020/2/7.
13. Subia, G., Amaranto, J., Bustamante, J., Damaso, I.: *Chess and Mathematics Performance of College Players: An Exploratory Analysis*. In: OALib. 06, 2019, p. 1-7. 10.4236/oalib.1105195.