

Enhancing Verbal Reasoning of School Children through Chess Learning

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Abstract— Verbal reasoning embraces the collective ability of a person to comprehend the meaning of verbal information in whatever forms it is presented, enabling the individuals' thought processes consequently to further process the given information. It is the process of gathering information, analyzing, thinking, and evaluating it to form ideas, beliefs, and assumptions and widen knowledge on the particular subject. While the impact of chess training on intelligence, creativity, and working memory has been studied, its impact on verbal reasoning needs to be explored. This study examined the outcome of 1-year systematic chess training on the verbal reasoning of children. A pretest–posttest with control group design was used, with 70 children in the experimental group (mean age 11.05; SD 2.49) and 81 children in the control group (mean age 11.10; SD 2.37). The sample consisted of children studying in two government schools and two private schools (grades 3–9), which included both the genders. The experimental group underwent weekly chess training for an hour, while the control group was involved in other games offered in school such as cricket, football, hockey, etc. Verbal reasoning was measured by Binet–Kamat Test of Intelligence. The chess training intervention included Winning Moves Chess Learning Curriculum, video lectures, demonstration board learning, on-the-board playing and training, chess exercises through workbooks, and studying tactical and end game positions by case studies. They also recorded the games by writing score sheets and the games were analyzed. ANCOVA revealed significant gains in verbal reasoning in the experimental group compared to the control group. There was a significant improvement in overall intelligence, revealed by t-test for the experimental group. No significant interaction effects were seen between intervention and gender and type of school on verbal reasoning. The present study establishes a link between chess training and verbal reasoning. Strengthening verbal intelligence and reasoning skills leads to important outcome in the child's overall development and academic performance.

Keywords— Chess training, cognitive development, processing speed, schoolchildren.

I. INTRODUCTION

The ability to gather, analyze, and understand information in the form of words and languages is called verbal reasoning. It involves reading, writing, speaking, and listening and forms an integral part of a formal education. Verbal reasoning is one of the four basic cognitive skills that are essential to communicate efficiently with everybody around us and arrive at conclusions and make decisions based on the information available. Any learning process essentially involves verbal reasoning through word-based concept formation. Verbal reasoning includes the collective ability of a person to understand the meaning of certain information in whatever forms it is presented, enabling his or her thought processes thereafter to learn the given information. It is the process of gathering information, analyzing, thinking, and evaluating it to form ideas, beliefs, and assumptions and develop knowledge on the particular subject. Most children develop verbal reasoning right from 3 to 4 years of age. It is an important tool for academic learning and for success in one's professional life.

The impact of chess on cognitive functions and academic performance has been fairly well established [1-4]. It is evident that chess makes children smarter [5]. It does this function by teaching the following skills:

- Focusing: Children are taught to learn about the advantages of observing and focusing.
- Visualizing: Children are encouraged to imagine a series of actions before it occurs by training

- Thinking ahead: Children are taught, first of all, to think and later to move on or act. Chess helps to develop calmness or attentiveness.
- Weighing options: Children learn not to impulsively respond but to check the other choices and make decisions based on evaluations of all options.
- Analyzing concretely: Children learn to assess the results of particular actions and arrangements.
- Thinking abstractly: Children learn to apply patterns to various or related situations especially when they discover them in one specific context.
- Planning: Children are taught to define long-term goals and do their best to achieve them.

Given the academic benefits of chess, Meyers [6] asserts that “we have brought chess to school because we believe that it can directly contribute to academic performance.”

A pioneering study was conducted by Frank [7] in Zaire. This study included 92 students, aged 16–18 years who played chess. The chess-playing experimental group showed a significant advancement in spatial, numerical, and administrative-directional abilities, along with verbal aptitudes, compared to the control group. The improvements held true regardless of the final chess skill level attained.

In a significant early study, Ferguson [8] assessed the cognitive skills of children in a 6th-grade self-contained classroom who participated in chess. Students played chess daily between the end of September and the end of May and were administered a pre- and posttest using the Test of

Cognitive Skills Memory subtest and the Verbal Reasoning subtest of the California Achievement Tests. A total of 14 students completed both the pre- and posttests. Statistical analysis was conducted using the *t*-test, comparing the experimental group with national norms. The experimental group demonstrated statistically significant improvement in both memory ($p>0.001$) and verbal reasoning ($p>0.002$).

Eberhard [9] found statistically significant improvements of verbal reasoning abilities for all students in the experimental chess instruction group, but not for the control group that did not receive chess instruction.

Joseph et al. [10] examined the effect of chess training on academic performance of middle-school children in rural India. The impact of chess on various academic courses of 100 students of 6th grade was examined. The sample consisted of an intervention group undergoing chess training and a control group. Statistical tests were carried out to examine whether the performance of students improved after chess intervention. The results of the paired samples *t*-test analysis showed significant improvement in academic performances of students in English, social studies, and science, after a year of training in chess skills.

Joseph et al. [11] assessed the impact of chess intervention on the IQ scores of children and analyzed the cognitive functions that contributed to the IQ gain. Eighty-six schoolchildren, boys and girls, in the age group 4–15 years, undergoing chess training in academy were assessed using Binet–Kamat Test of Intelligence. Chess intervention consisted of standardized biweekly training sessions of 2 hours duration over a period of 1 year. Paired *t*-tests and regression analysis were carried out. Significant increases were observed in IQ, and regression analysis indicated that nonverbal reasoning, language, and memory significantly contributed to the dependent variable IQ.

While a number of studies have established that chess learning clearly improves cognitive functioning and academic performance, its impact on verbal reasoning is yet to be ascertained. It is likely that an increase in verbal reasoning is one of the basic factors that supports these gains. However, very few studies appear to have focused on the role of chess training in strengthening verbal reasoning.

It is hypothesized that systematic chess training would significantly increase verbal reasoning in children. The objective of the study was to assess the impact of weekly chess training on the verbal reasoning of school-going children.

II. METHODOLOGY

The research design used for the study was pretest–posttest with control group design [12, 13]. The independent variable was the chess training program and the dependent variable was verbal reasoning of children.

The sample consisted of school-going children with 70 children in the experimental group and 81 children in the control group. The children were selected based on the following selection criteria:

- Children who are studying in schools
- Both genders

- Age range between 6 and 14 years (grades 3 to 9)

The mean age for experimental group was 11.05 years ($SD=2.49$) and for control group was 11.10 years ($SD=2.37$). The experimental group consisted of 27 girls and 43 boys and the control group consisted of 29 girls and 52 boys.

A. Tools

Verbal reasoning was assessed using the Binet–Kamat Test of Intelligence. The Stanford revision of the test was adapted as the Binet–Kamat Test of Intelligence to suit the Indian children. The present version consists of various verbal and performance tests that can be administered to children and adults from ages 3 to 22 years. Validity of the test shows that when a fourfold table was drawn up and the correlation of the pluses and minuses of each test with mental age as obtained by the whole scale was found, the correlation coefficients of the tests were generally higher than 0.70. Correlations between IQ (as determined by the scale) and the teacher's estimates were found to be nearly 0.50, which is fairly high considering the variability of the teacher's estimates.

B. Chess Training Methodology

The training methodology comprised of Winning Moves Chess Learning Program [14] Episodes 1–22, lectures with the demonstration board, on-the-board playing and training, chess exercise through workbooks (Chess school 1A, Chess school 2, and tactics), and working with chess software. Further student's games were mapped using chess base software and the brain patterns of the children were understood. They were taught the ideas behind chess openings and exposure to classical games were also given. The children participated in mock as well as regular tournaments.

III. PROCEDURE

Baseline assessment of verbal reasoning was done after obtaining informed consent. Reassessment was carried after an average duration of 1 year. Psychologists were trained to administer the test in a uniform standardized method to minimize the testing error. Children with an IQ below 80 were excluded from the sample.

Clustering technique was used to form the training groups of 6 to 8 children. The chess training consisted of once a week chess classes conducted for 1 hour during school hours at the end of the day. The children were given a standardized Winning Moves Chess Learning Program [14] and played at tournaments also.

IV. RESULTS

The analysis was carried out using SPSS. Analysis of covariance was carried out to establish the significance of the difference between the experimental and control groups on the verbal reasoning scores following intervention, holding the preintervention scores as covariate (Table I).

TABLE I. Significance of the difference between the means of the experimental and control groups on verbal reasoning using analysis of covariance.

Scores	Assessment	Mean and Standard Deviation	
		Experimental	Control
Verbal reasoning	Pre	2.80	2.59
		(3.767)	(3.471)
	Post	5.63	3.68
		(4.985)	(3.748)

TABLE II. Dependent variable: post verbal reasoning.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected model	1252.293 ^a	2	626.147	53.615	0.000
Intercept	658.081	1	658.081	56.35	0.000
Preverbal reasoning	1109.575	1	1109.575	95.01	0.000
EXPCON	120.591	1	120.591	10.326	0.002*
Error	1728.422	148	11.679		
Total	6152	151			
Corrected Total	2980.715	150			

*p<0.05

Table II indicates that there was a significant effect of intervention on verbal reasoning at post intervention ($p<0.05$). This shows that the mean verbal reasoning increased in the experimental group following intervention, compared to the control group.

V. DISCUSSION

While the impact of chess on cognitive functions and academic performance has been widely researched and clearly established [1-4], its influence on strengthening verbal abilities in general and verbal reasoning in specific remains unresearched to a great extent.

The findings of the present study are noteworthy because chess playing has clearly shown a significant increase ($p<0.05$) in verbal reasoning scores. The tasks on which changes were measured are Absurdities subtest and the Problem Question subtest.

The chess intervention that was carried out had a strong reasoning component where the child thinks through and reasons out the best possible moves given a certain playing position. Further, they are trained to record notations of their games, discuss, and analyze their moves from their scoresheets. The chess notation is a two-dimensional learning strategy where they record the movement of pieces, noting the column and the rows. Further, while analyzing a position, a chess player thinks using the notations by verbalizing it subvocally. These activities sharpen their abilities and strengthen their ability to think clearly and logically resulting in an enhancement of their verbal reasoning ability. These outcomes are likely to occur in chess, an intervention which actively incorporates a methodology where the child/player

transcribes the movement of pieces into a language (chess notations).

Joseph et al. [10] in their study measuring academic performance following chess training have reported increased scores in English and other subjects. The improved English scores could probably reflect a strengthening of the underlying augmented verbal reasoning skills. It is likely that chess training has an impact on not merely verbal reasoning but verbal ability such as language, reading, comprehension, and so on. The children in Ferguson's [8] study demonstrated an increase in their reading scores.

VI. IMPLICATIONS

Built in to the chess training methodology used in the present study is a component that strengthens verbal ability and reasoning. Such a curriculum has obvious benefits leading to academic, cognitive, and whole person development of the child.

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