## Title

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## Authors

Joseph, Ebenezer
Manoharan, S. Sundar
Easvaradoss, Veena
et al.

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# A Study on the Impact of Chess Training on Creativity of Indian School Children

**Ebenezer Joseph (emmanuelchess@gmail.com)**
University of Madras,
Department of Psychology, WCC, College Road, Chennai, 600006, India.

**S. Sundar Manoharan (ssm@karunya.edu)**
Karunya University
Coimbatore, 641114, India.

**Veena Easvaradoss (veenadoss@gmail.com)**
Department of Psychology, Women's Christian College
College Road, Chennai, 600006, India.

**David Chandran (davidbeulah@gmail.com)**
Emmanuel Chess Centre
Kasthuri Ranga Road Chennai, 600018, India.

**Abstract**

Creativity is the ability to produce work that is both novel and appropriate. The study, funded by Indian government, analyzed the effect of one-year chess training on the creativity of children. A pretest and posttest with control group design was used, with 31 children in experimental and 32 in control group. The experimental group underwent weekly chess training. Wallach-Kogan Creativity Test (Indian Adaptation) was used. Analysis revealed that only the experimental group had statistically significant gains in total creativity and two nonverbal subtests. The authors conclude that systematic chess training inculcates in the child the ability to think divergently and creatively.

**Keywords:** Abstract Thinking; Chess Training; Creativity; Innovation; Divergent Thinking

## Introduction

*Creativity* is defined as the tendency to generate or recognize ideas, alternatives, or possibilities that may be useful in solving problems, communicating with others, and entertaining ourselves and others (Franken, 1982). Typically creativity is defined as "the ability to produce work that is both novel (i.e. original, unexpected) and appropriate (i.e. adaptive concerning task constraints)" (Sternberg, 1999). These definitions emphasize both the concept of fluency and novelty in the responses that have been generated.

Most theorists agree that the creative process involves a number of components, most commonly:

1. Imagination
2. Originality (the ability to come up with new and original ideas and products)
3. Productivity (the ability to generate a variety of ideas through divergent thinking)
4. Problem solving (application of knowledge and imagination to a given situation)
5. The ability to produce an outcome of value and worth

Creativity is commonly utilized divergent thinking. A creative or divergent thinker is described as the person who pushes the boundaries of ability and knowledge and is able to reconsider the problem to find different perspectives and solutions and ignore distractions that can negatively affect his or her productivity (Saccardi, 2014). Creativity among children emerges gradually between grades one to three (Torrance, 1964). In general, the broad and complex multidimensional concepts of creativity can be measured by the Torrance Tests of Creative Thinking (TTCT: Torrance, 1964, 1990a, 1990b) and the Wallach–Kogan Creativity Tests (WKCT: Wallach & Kogan, 1965).

There is a fairly common belief that creativity can be developed through training. Various recent studies that have assessed the effects of programs for stimulating creativity confirm this belief (Antonietti, 2000; Fleith, Renzulli, & Westberg, 2002; Komarik & Brutenicova, 2003; Saxon, Treffinger, Young, & Wittig, 2003). Consequently, many countries are increasingly placing a high priority on stimulating creative thinking at the school level.

Since chess helps in developing strategic thinking and problem-solving skills of children, it may also be effective in improving their cognitive skills (Sigirtmac, 2016). Chess builds problem-solving abilities, enhance strategic thinking skills, and even improves self-esteem as well as higher-order thinking skills, which are known as meta-cognitive skills. In countries, where chess is intensely played by students, practicing students become among the top students in mathematics and science and they are able to recognize complicated patterns (Milat, 1997).

While a number of other models of creativity have brought out the steps involved in the creative process, Avni (1998) posited a four-step model specific to chess playing. According to him, an intelligent process in playing chess consists of four different steps: synthesis (opinion forming and plan shaping), gathering (collecting the raw materials during position evaluation), enlightenment (a sudden observation of an idea), and realization (translating the idea into practical lines of play). Thus, these four steps can be

used for a creative process that could also work in some other areas (Bushinsky, 2009).

India has a long history of chess playing but there are only a few studies on chess as a strategy to increase cognitive abilities. Further, there are no studies assessing the impact of chess intervention on the creativity of children. If research can establish that chess training can facilitate creativity, it can significantly impact educational programs to increase creative thinking.

The objective of the study was, therefore, to analyze the effect of one-year chess training program on the creativity of school-going children of both genders and to assess its effect on the verbal and nonverbal components of creativity. It was hypothesized that chess training would significantly increase creativity in children.

## Methodology

The research design used for the study was pretest and posttest with control group design. The independent variable was the Chess training program, and the dependent variable was Creativity of children.

The sample consisted of 63 children, 31 in the experimental group and 32 in the control group. The children in the experimental group were selected purposively and comprised children who volunteered for the chess program. The children in the control group were randomly selected using random numbers table generated online. The children in the control group were selected on the basis of no chess knowledge and were not given chess training. During the time of chess intervention for the experimental group, the control group children were engaged in other activities such as music, arts and in outdoor sports such as cricket, football, basketball, etc. The mean age for experimental group was 11.86 years (SD = 1.44) and for control group was 12.03 years (SD = 1.14). The experimental group consisted of 9 girls and 22 boys, and the control group consisted of 7 girls and 25 boys.

### Tools

Creativity was assessed by Indian adaption of Wallach-Kogan Creativity Test. The WKCT (Wallach & Kogan, 1965) is similar to the TTCT in that it focuses on divergent thinking and assesses both visual and verbal content. It includes three verbal subtests—Instances (e.g., name all the round things you can think of), Alternative Uses (e.g., for a newspaper), and Similarities (e.g., How are a cat and mouse similar?)—and two figural subtests—Pattern Meanings and Line Meanings (interpreting abstract patterns and lines). It is scored for fluency (number of ideas) and uniqueness (ideas not offered by others in the group being tested). Wallach and Kogan's (1965) major contribution was their belief that standardized test procedures were not conductive to creative performance and their insistence on a more relaxed and game-like atmosphere. The test is given individually, and no time limits are imposed. However, in the present administration, a time limit of three minutes was given for each subtest. The number of valid responses for each subtest was summed to obtain the subtest totals. The total creativity scores comprised the sum of the subtest scores.

### Chess Training Methodology

The children were grouped into small clusters based on the chess ability and learning capacity and were trained for an hour starting from the basics. The training methodology comprised Winning Moves Chess Learning Program (Joseph, 2008) 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 softwares. Further students' games were mapped and analyzed using score sheets and Chess software. The children were taught the ideas behind chess openings, and exposure to classical games was also given. The children participated in mock as well as regular tournaments. On an average, the children underwent one hour per week chess intervention for about 25-30 sessions. One coach was assigned for 8 students.

## Procedure

Baseline creativity assessment was done after obtaining informed consent, from the parents and the school authorities. The research was carried out on the approval of government of India, department of science and technology, Task force and the doctoral committee. Reassessment was carried out after an average duration of one year. The assessment environment was quiet without any disturbance and kept standardized. Psychologists were trained to administer the test in a uniform standardized method to minimize the testing error.

Clustering technique was used to form the training groups of six to eight children. The chess training consisted of once-a-week chess classes conducted for one hour during the end of school hours for a year (about 30 hours of chess training). The children were given a standardized Winning Moves Chess Learning Program (Joseph, 2008), and they played at tournaments also.

## Results

The analysis was carried out using SPSS. Paired *t*-test was carried out to analyze differences within groups, and independent *t*-test was used to assess differences between groups in the mean total creativity scores and mean subtest scores. Pre-intervention equivalence of groups on creativity was established for total creativity scores and the subtest scores.

Table 1: The Significance of the Difference between the Means of the Experimental and Control Groups on the Creativity Test using the Independent *t*-Test.

| Scores | Assessment | Mean and Standard Deviation | | *t* |
|---|---|---|---|---|
| | | Experimental | Control | |
| Total creativity | Pre | 54.19<br>16.98 | 53.93<br>12.38 | 0.06 |
| | Post | 16.90<br>18.77 | 52.40<br>17.12 | 2.09* |
| Instances | Pre | 13.74<br>6.34 | 15.81<br>5.26 | -1.41 |
| | Post | 17.41<br>6.79 | 16.78<br>5.92 | 0.39 |
| Alternate Uses | Pre | 9.09<br>3.66 | 10.09<br>3.03 | 1.17 |
| | Post | 10.87<br>3.66 | 9.46<br>4.22 | 1.40 |
| Similarities | Pre | 7.74<br>3.51 | 7.96<br>3.52 | 0.25 |
| | Post | 9<br>4.47 | 7.93<br>3.74 | 1.01 |
| Line Drawing | Pre | 11.77<br>4.98 | 9.96<br>3.99 | 1.58 |
| | Post | 12.12<br>4.22 | 8.65<br>4 | 3.34** |
| Pattern Meaning | Pre | 11.83<br>4.68 | 10.09<br>3.74 | 1.63 |
| | Post | 12.80<br>4.81 | 9.87<br>4.11 | 2.59** |

*$p < .05$; **$p < .01$.

Table 1 indicates that there was a significant difference between the means of the post-intervention total creativity scores ($p < .05$) Cohen's d indicated an effect size of (0.52), indicating that chess training had significantly increased creativity. Significant differences between the post-intervention means were observed on the Line Drawing subtest ($p < .01$) Cohen's d effect size (0.84) and the Pattern Meaning subtest ($p < .01$) Cohen's d effect size (0.68) , indicating that chess training had significantly increased the scores on these two subtests. No significant differences were observed on any other subtest.

## Discussion

It can be inferred from Table 1 that systematic chess intervention increases creativity in children. As research has clearly established, chess is a game that stimulates cognitive processes and strengthens intellectual abilities and cognitive skills (Aciego, García, & Betancort, 2012; Bilalic, McLeod, & Gobet, 2007; De Bruin, Kok, Leppink, & Camp, 2014). Moreover, it has shown that the intellectual gains have translated into increases in both IQ and academic scores (Aydın, 2015; Barrett & Fish, 2011; Joseph, Easvaradoss, & Solomon, 2016; Romano, 2011). Large Effect Sizes for Total Creativity (0.52), Line Drawing (0.84) and Pattern Meaning (0.68) where seen, indicating that chess had a significant impact on Total Creativity, Line and Pattern subsets of the experimental group. This finding was in line with Sigirtmic (2016), findings who found a statistically significant difference between elaboration, resistance to premature closure and total creativity score of children in favour of those who received chess training.

In the present study, the children were taught chess systematically. They did not merely play chess but were strongly encouraged to challenge their own standards and also to play competitively. They analyzed their own games, identified their strengths, and understood their mistakes. They were also given opportunities to pit their skills against others as they played in tournaments. It is clear that the outcome of this rigorous, yet enjoyable, training methodology was the enhanced cognitive abilities that were reflected in increased creativity scores.

The intellectual strategies underlying chess playing have been spelt out by Avni (1998). According to him, chess playing involves an intelligent process that consists of four different steps: synthesis (opinion forming and plan shaping), gathering (collecting the raw materials during position evaluation), enlightenment (a sudden observation of an idea), and realization (translating the idea into practical lines of play). The child thinks beyond the usual solutions using divergent thinking, thinking abstractly, weighing options, evaluating outcomes, and making decisions. Insightful thinking also appears to play a role.

The Wallach-Kogan Test, which was used in the present study, requires the child to think divergently, quickly, and fluently, generating as many responses as possible on the different tasks. It is evident that similar abilities are utilized in playing chess where innovativeness and accuracy and both broad-based and precise thinking are required. The experimental group, which had undergone one-year training, in chess appears to have acquired these skills as indicated by a significant increase in overall creativity compared to the control group. Earlier studies have pointed to the positive impact that chess has had on academic scores, especially language and reasoning (Joseph et al., 2016). The components of creativity studied on the test are the ability to name objects that have common properties involving abstraction ability (Instances), to identify multiple uses for common objects involving divergent thinking (Alternate Uses), to perceive similarities between two different objects utilizing generalizing and abstracting ability (Similarities), to perceive meaning in meaningless stimuli involving innovativeness (Line Drawing), and to perceive meaning in structures stimuli involving the ability to form association (Pattern Drawing). The children in the experimental group have shown increases in all the post-intervention scores, though not all increments have reached significance.

Significant increases have been observed on the Line Drawing subtest ($p < .01$) and the Pattern Meaning subtest ($p < .01$) as seen in Table 1. On the Line Drawing subtest, the child is shown a line drawing for 30 seconds and is asked to generate as many responses as possible about what the drawing means to him or her. On the Pattern Meaning subtest, the child is shown a design (which is more

structured) and is asked to generate as many responses as possible about what the design means to him or her. This test measures fluency and the ability to uncritically generate ideas and possibilities, both commonplace and unique. The game of chess uses primarily visuospatial strategies. Systematic chess training inculcates in the child the ability to think divergently, visualizing the pros and cons of the various chess moves.

Garaigordobil (2006) studied the impact of a play program on the verbal and graphic-figural creativity. Results showed a positive effect of the intervention, as the experimental participants significantly increased their verbal creativity and graphic-figural creativity. This research primarily focused on structured cooperative play. The chess intervention in the present study also has structural characteristics that corroborate the finding of other studies that had indicated positive effects of play on the development of creativity. This structured quality helps the child to systematically visualize all the possible options and outcomes available to him or her. This ability, which has been acquired through chess training, has led to the increased total creativity scores and the increases on the visuospatial subtests.

## Implications

It is evident that systematic chess intervention increases creativity in children. The child thinks beyond the usual solutions—using divergent thinking, thinking abstractly, weighing options, evaluating outcomes, and making decisions. Significant improvement in the Line Drawing and Pattern Meaning subtest substantiates the fact that the game of chess primarily uses visuo-spatial strategies. Systematic chess training inculcates in the child the ability to think divergently, visualizing the pros and cons of various chess moves. It allows the child to conceptualize all the possible options and outcomes available to him or her. Increasing the creativity of children has possible far-reaching benefits for academic performance and generally for life skills. Systematically learning chess as part of school activities appears to have a broad spectrum of positive outcomes. The child who develops the ability to think in creative ways in playing chess is likely to transfer this learning to dealing with life challenges creatively.

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