

Study III. The USA Junior Chess Olympics Research: Developing Memory and Verbal Reasoning

During the 1987-88 investigation, all students in a sixth grade self-contained classroom at M.J. Ryan School (a rural school about 18 miles from Bradford, PA, with a student enrollment of 116 in grades K-6) were required to participate in chess lessons and play games. None of the pupils had previously played chess. This experiment was more intensified than Ferguson's other studies because students played chess daily over the course of the project. The project ran from September 21, 1987 to May 31, 1988.

The dependent variables were the gains on the *Test of Cognitive Skills (TCS)* Memory subtest and the Verbal Reasoning subtest from the *California Achievement Tests* battery. The differences from the pre and posttests were measured statistically using the t test of significance. Gains on the tests were compared to national norms as well as within the treatment group. The differences between males and females on the tests were also examined.

The mean IQ of the class participants was 104.6. All students were required to take basically the same chess course (the *USA Junior Chess Olympics Training Program*) used in Ferguson's first two studies. A total of 14 pupils (9 boys and 5 girls) completed both the pre and posttests (*TCS* Memory test and Verbal Reasoning test).

Generally, students received chess lessons two or three times each week and played chess daily. Many students competed in rated chess tournaments outside of school. Seven competed in the PA Scholastic Chess Championship, and two went on to Nationals.

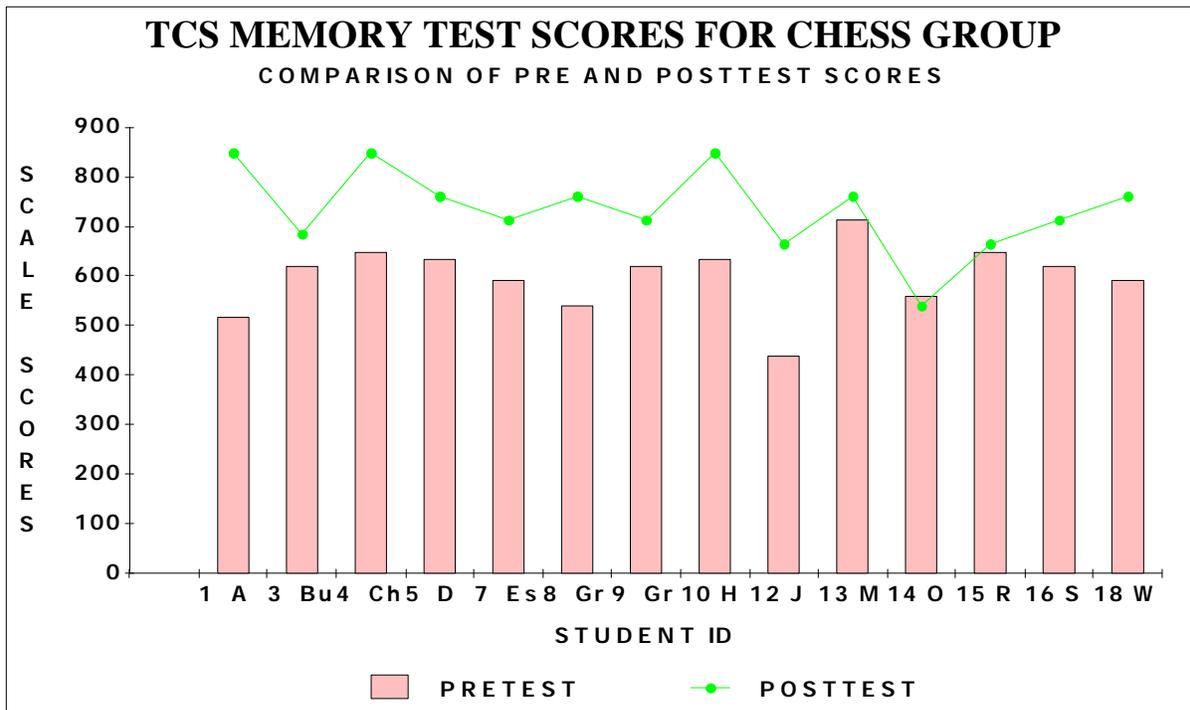


FIGURE 1. Comparison of pretest and posttest scores on the *TCS* Memory test

Results and Data Analysis

All scores reported for the *Test of Cognitive Skills (TCS)* are listed as *scale scores*. Scores have been converted from number correct scores to scale scores using conversion Table 3 in the *TCS Norms Book* for level 3. According to the *Norms Book*, "The scale score is the basic score for *TCS*. This score is especially appropriate for research studies and statistical analyses . . ."

As listed in the *TCS Technical Report* (1983), the mean scale score on the Memory test for sixth graders across the nation is 591. The pretest mean score for the sixth grade students in this study scored an average of 597.786. There is no significant variance between the norms and the test group.

The posttest scale scores averaged 727.786 for a mean gain of 130 points. Inspection of the scores in Figure 1 on the first page shows that all but one student demonstrated a gain. By using Table 6 in the *Norms Book*, the project director calculated the mean pre and post percentile ranks to be 59% and 91%, respectively, for a gain of 32%. This increased percentile score indicates an *above average* performance.

An *average* student in the sixth grade scores at the 50th percentile on the subtests of the *TCS*. If the student continues to grow in proficiency at an average rate throughout the year, that student will again score at the 50th percentile in seventh grade. Considering that no percentile gain is the norm, the chess group's gain of 32 in percentile score appears significant.

Because percentile scores are considered inappropriate for statistical analysis, the director used the scale scores to perform the t test. The t test measures the quantity of the gain to assess whether it is significant.

When comparing the treatment group to the sixth grade national norms, the obtained t equals 5.926, which is statistically significant beyond the .001 level. Even when the researcher compared the sixth graders' posttest results to those of the seventh grade norms, the t test resulted in an obtained t=5.493, which is statistically significant beyond the .001 level. Thus the chances are less than one in a thousand that these gains were due to chance.

TABLE A. Dependent t test evaluating significance of gains on the *TCS* Memory test by chess players

VARIABLE	NUMBER	MEAN
Pretest Scores	14	597.786
Posttest Scores	14	727.786
Difference	Standard Error	t value
130	24.86	5.23
Significant beyond the .001 level		

As listed in the *TCS Technical Report*, the mean scale score on the Verbal Reasoning test for sixth graders across the nation is 578. The pretest mean score for the sixth grade students in this study scored an average of 568.214. Although the scale score norms are nearly 10 points higher for the national sample, there is no significant variance between the norms and the test group.

By using Table 6 in the *Norms Book*, the project director calculated pre and post percentile ranks to be 45% and 61%, respectively, for a gain of 16% (about half the increase noted on the Memory test). Remembering that no increase in percentile score is the norm, it is possible to conclude that the chess group's score does indicate an *above average* performance.

Because percentile scores are inappropriate for statistical analysis, the director used the scale scores to perform the t test. The posttest scale scores averaged 620.714 for a mean gain of 52.5 points. The obtained t equals 4.018, which is statistically significant at the .002 level. Review of the scores in the table below shows that there are only two chances in a thousand that this result could have happened by coincidence.

TABLE B. Dependent t test evaluating significance of gains on the TCS Verbal Reasoning test by chess players

VARIABLE	NUMBER	MEAN
Pretest Scores	14	568.214
Posttest Scores	14	620.714
Difference	Standard Error	t value
52.5	13.066	4.018
Significant at the .002 level		

Table C. Statistical summary of t tests for TCS

TABLES	MEMORY	VERBAL REASONING
	<i>p</i> <	<i>p</i> <
MALES & FEMALES COMBINED:		
Dependent Chess Group	0.001	0.002
Population Mean Chess vs. National Norms	0.001	0.066
MALES:		
Dependent Chess Group	0.001	0.01
Population Mean Chess vs. National Norms	0.001	0.128
FEMALES:		
Dependent Chess Group	0.045	0.11
Population Mean Chess vs. National Norms	0.077	0.406

Conclusions

It is evident from the above tables and data that chess had a definite impact on developing both memory and verbal reasoning skills. The effect of the magnitude of the results is strong (*eta*² is .715 for the Memory test gain compared to the Norm). Because the sample size of the treatment group was only 14 students, the author would encourage replication of this study.

It was also evident that there were significant gains in the participants' chess skills. Seven of the boys involved in this study participated in the March 1988 Pennsylvania State Scholastic Championship. After having played chess for only five months, they finished second (only half a point behind Steve Shutt's nationally famous team from the Frederick-Douglass School in Philadelphia). One pupil even made the top fifty list for his age group.

The project director concurs wholeheartedly with Dr. Stephen M. Schiff (1991), who wrote: ". . . the study of chess is one of the most critically important additions to the curriculum that schools can offer to our pre-adolescent gifted and talented student population." Based on the results of Study III and others, this researcher *urges* the inclusion of chess to augment the skills of both the gifted and the nongifted.

The *USA Junior Chess Olympics Training Program* used in each of Ferguson's studies undeniably demonstrated effectiveness in bringing about the desired changes in the participating students. This author would strongly recommend the adoption or adaptation of the *USA Junior Chess Olympics Training Program* within the school curriculum throughout the country.

For Those Who Haven't Studied Statistics

"Tradition holds that the level of significance must be expressed as *the probability that a true null hypothesis is being rejected*. That means that the *lower* the significance level, the *higher* is our confidence that the effect we have observed is real." (Phillips, Statistical Thinking: A Structural Approach, p. 85, 1973)

A *significant* difference is less than **.05** (often written $p < .05$). A *very significant* difference is one for which the probability of having occurred by sampling error is less than 1% (**.01**) and is frequently written $p < .01$. In the statistical summary (Table C), the *very significant* levels have been **bolded**.

For Additional Information

The above material is a brief synopsis of the information found in a paper (200+ pages) by Robert Ferguson entitled *Teaching the Fourth "R" (Reflective Reasoning) Through Chess*. If you would like a more comprehensive review of this research and his first two studies, send a check for **\$39.95** payable to the American Chess School at the address below. *All profits from the sale of this publication are used to support chess in the schools.*

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