

Chess and Standard Test Scores

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Summary: Regular (non-honors) Elementary students who participated in a school chess club showed twice the improvement of non-chessplayers in Reading and Mathematics between third and fifth grades on the Texas Assessment of Academic Skills. In fifth grade, regular-track chessplayers scored 4.3 TLI points higher in reading ($p < .01$) and 6.4 points higher in math ($p < .00001$) than non-chessplayers.

The purpose of this study is to document the effect of participation in a chess club upon the standardized test scores of elementary school students. The study was conducted in four of the elementary schools in a large suburban school district near Houston, Texas. It compared the third grade and fifth grade scores on the Texas Assessment of Academic Skills (TAAS) of students who participated in a school chess club in fourth and/or fifth grade with the scores of students who did not participate in a chess club. Significant improvement in math and reading scores were found among the regular track chess students.

BACKGROUND

Previous studies indicating the effects of chess on scholastic achievement have received little notice, and have been criticized for small sample size, or for chess clubs being self-selective elite groups, or for being too anecdotal. Many observations by teachers, parents, administrators, and students report advantages of participation in chess, based principally upon improved self-image, confidence, and critical thinking skills.

As reported in *Developing Critical and Creative Thinking Through Chess*, Robert Ferguson (of Bradford, Pennsylvania), tested students from seventh to ninth grades, (1979-1983), as part of the ESEA Title IV-C Explore Program, and found:

Watson-Glaser Critical Thinking Appraisal
(Average Annual Increase):

Chess 17.3%; Non-Chess 4.6%;

Torrance Tests of Creative Thinking:

Fluency: Chess 19.9%; Non-Chess 6.0%;

Flexibility: Chess 22.8%; Non-Chess 9.5%;

Originality: Chess 70.0%; Non-Chess 34.8%

The mathematics curriculum in New Brunswick, Canada, is a text series called

Challenging Mathematics, which uses chess to teach logic from grades 2 to 7. Using this curriculum, the average problem-solving score of pupils in the province increased from 62% to 81%.

Reports from students, teachers, and parents not only extol the academic benefits of chess on math problem solving skills and reading comprehension, but also report increased self-confidence, patience, memory, logic, critical thinking, observation, analysis, creativity, concentration, persistence, self-control, sportsmanship, responsibility, respect for others, self esteem, coping with frustration, and many other positive influences which are difficult to measure but can make a great difference in student attitude, motivation, and achievement.

SCHOOLS SURVEYED

The four elementary schools surveyed serve affluent and middle class neighborhoods. The 571 students completing fifth grade in 1997 were 11% Asian, 11% Hispanic, 6% Black, 1% American Indian, and 71% "Other." The sample was 11.7% Chessplayers (67), 88.3% Non-chess (504).

Comparing the groups:

| | Percent | M | F | SE | Reg | AA | GT |
|---------|---------|------|------|------|------|------|----|
| Overall | 50.8 | 49.2 | 13.1 | 53.4 | 14.9 | 18.6 | |
| Chess | 74.6 | 25.4 | 13.4 | 34.3 | 20.9 | 31.4 | |

SE: Special Education students

Reg: Regular students

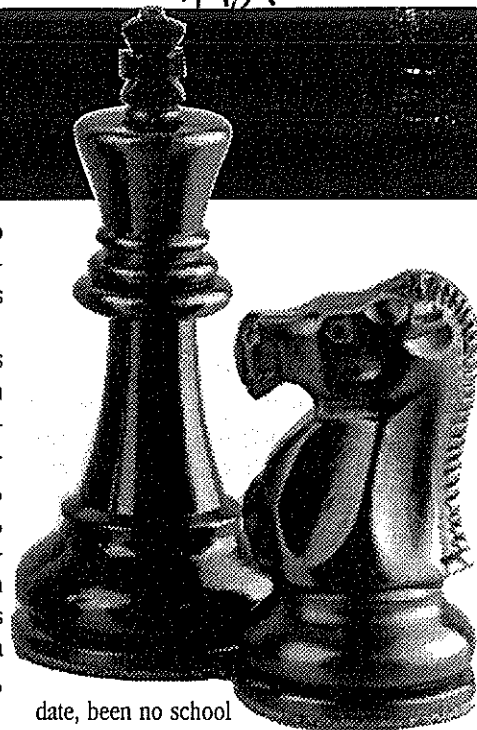
AA: Academically Able students judged upon a matrix of IQ and achievement

GT: Gifted and Talented students, the top-performing students judged by a similar matrix.

It can be noted that the chess group is 3:1 male and has a higher percentage of AA and GT students. The objection that this constitutes a self-selective elite group is answered by considering the four tracks separately.

The schools were selected because they had established chess clubs and maintained them for at least two years. They also had no chess instruction during school hours. Schools ranged in enrollment from 707 to 979 in grades K to 5, with chess clubs ranging from 35 to 80 in weekly attendance. One school restricted club membership to fourth and fifth grade students, the others third to fifth, with younger students allowed only if their parents were assisting. Clubs met for one hour after school one day per week. In one school, the faculty sponsor taught chess to club members. At the other schools, parents coordinated the program.

All of the clubs could use more adult workers, and especially faculty involvement. There has, to



date, been no school district funding of chess

activity and no compensation to faculty for their time. Chess equipment, consisting of boards and sets, have been contributed by Parent-Teacher Organizations, bought with School Activity funds (small amount), and borrowed from the high school club. Some students bring their own sets from home, and the only chess clocks available belong to students. Sets range from the \$3.99 hollow plastic set sold at discount stores to tournament quality plastic sets available for \$10 from a local tournament director. Expensive wooden sets are not practical for school use. Chess clocks start at \$40 each.

TAAS

The Texas Assessment of Academic Skills had been administered since 1990. It currently consists of reading and math tests in Grades 3-8 and 10 (Exit Level); writing at Grades 4, 8, and 10 (Exit Level); science and social studies at Grade 8. The focus is on assessing the instructional targets delineated in the essential elements, the state-mandated curriculum, and on higher-order thinking skills and problem-solving ability. The Texas Learning Index (TLI) allows for comparison across years and across grades. The minimum expectations score of 70 represents the same amount of achievement at each grade level. Thus a student with a Math TLI of 3-80 and 5-85 would have shown more than two years' typical improvement in reading between the third grade test and the fifth grade test.

METHOD

For this survey, TAAS TLI scores for reading and math at grades 3 and 5, placement, and sex information were obtained for all fifth graders at each

of the four schools. The school chess sponsors provided lists of students who had participated in chess clubs during fourth and/or fifth grade. The definition of "participated in" was left to the sponsor. The question of how much participation would produce any effect was not addressed. The data was compiled and averaged.

RESULTS (Average TLI Scores)

Chessplayers

| | Reading | | Mathematics | |
|---------|---------|--------|-------------|--------|
| | 3rd | 5th | 3rd | 5th |
| Total | 3-86.5 | 5-92.1 | 3-81.7 | 5-87.3 |
| Male | 3-87.0 | 5-92.6 | 3-82.3 | 5-87.4 |
| Female | 3-85.1 | 5-90.9 | 3-79.7 | 5-86.8 |
| Spec-Ed | 3-84.1 | 5-90.6 | 3-76.7 | 5-85.1 |
| Regular | 3-79.5 | 5-89.4 | 3-77.6 | 5-85.7 |
| AA | 3-89.6 | 5-94.3 | 3-85.6 | 5-88.6 |
| GT | 3-91.3 | 5-95.9 | 3-85.6 | 5-90.7 |

Non-Chessplayers

| | Reading | | Mathematics | |
|---------|---------|--------|-------------|--------|
| | 3rd | 5th | 3rd | 5th |
| Total | 3-83.1 | 5-87.4 | 3-77.2 | 5-81.8 |
| Male | 3-82.0 | 5-86.4 | 3-76.8 | 5-81.0 |
| Female | 3-83.9 | 5-88.3 | 3-77.6 | 5-82.5 |
| Spec-Ed | 3-73.5 | 5-77.5 | 3-68.2 | 5-74.6 |
| Regular | 3-80.6 | 5-85.1 | 3-73.9 | 5-79.3 |
| AA | 3-88.5 | 5-94.6 | 3-84.7 | 5-88.4 |
| GT | 3-91.7 | 5-96.6 | 3-86.9 | 5-89.6 |

(Increase in Average TLI Scores)

Chessplayers

| | Reading | Mathematics |
|---------|---------|-------------|
| | Total | 5.6 |
| Male | 5.6 | 5.1 |
| Female | 5.8 | 7.1 |
| Spec-Ed | 6.5 | 9.4 |
| Regular | 9.9 | 8.1 |
| AA | 4.7 | 3.0 |
| GT | 4.6 | 5.1 |

Non-Chessplayers

| | Reading | Mathematics |
|---------|---------|-------------|
| | Total | 5.6 |
| Total | 4.3 | 4.6 |
| Male | 4.4 | 4.2 |
| Female | 4.4 | 4.9 |
| Spec-Ed | 4.0 | 6.4 |
| Regular | 4.5 | 5.4 |
| AA | 6.1 | 3.7 |
| GT | 4.9 | 2.7 |

T-test of Statistical Significance for Regular Students Comparing Regular-Track Chess vs Non-Chess Students

| Reading | | |
|-------------|---------|-----------|
| Third Grade | t=.3956 | p=.6958 |
| Fifth Grade | t=2.809 | p=.008657 |

| Mathematics | | |
|-------------|---------|--------------|
| Third Grade | t=2.041 | p=.05078 |
| Fifth Grade | t=5.232 | p=.000006155 |

T-test of Statistical Significance for Special Ed Students Comparing Special-Ed Chess vs. Non-Chess Students

| | | |
|-------------|---------|----------|
| Fifth Grade | t=4.228 | p=.00119 |
|-------------|---------|----------|

ANALYSIS

The largest difference in the amount of improvement in TLI scores from third to fifth grade was among the regular students. In this group, the chessplayers showed significant improvement compared to non-chessplayers. The statistical t-test showed that in third grade reading, there was no difference between the chess and non-chess groups, but by fifth grade, the difference ($p < .01$) is "highly significant." In mathematics the chess group was very marginally distinguished from the non-chess in third grade ($p = .05$), but by fifth grade was clearly a different population (null hypothesis rejected at $p < .00001$).

Among Special Education students, the effect was not as great, but was probably statistically significant (Reading $p = .0001235$, Math $p = .00119$) except for the small sample (9 chessplayers). Anecdotal reports concerning Special Education Chessplayers stress increased self-esteem and confidence, primary objectives for these students. The results for AA and GT students are mixed. But their TLI scores in the upper 80s and 90s have less room to show improvement.

Regular track fifth grade chessplayers scored 4.3 TLI points higher in reading ($p < .01$) and 6.4 points higher in mathematics ($p < .00001$) than non-chessplayers.

RECOMMENDATIONS

School chess clubs should be encouraged at Elementary, Middle, and High School levels, open to all students; modest funding or fund-raising opportunities to provide equipment and travel to tournaments should be provided; and faculty sponsors should receive some token compensation for their extra time and effort. Parent involvement is essential in Elementary clubs and highly desirable in Middle School clubs, for instruction, crowd control, and transportation.

While chess should never substitute for instruction in school subjects, it would make a worthwhile enrichment or supplement activity, particularly for the "Regular" students. Some teachers report success using chess as an incentive, as in "Settle down and finish this history lesson, and then you can play chess."

Funding for chess activity is available under the "Educate America Act" (Goals 2000), Public Law 103-227, Section 308.b.2.E.

"Supporting innovative and proven methods of enhancing a teacher's ability to identify student learning needs and motivating students to develop higher order thinking skills, discipline, and creative resolution methods."

The original wording of this section included "such as chess" and passed both houses of Congress that way. But the phrase was deleted later in Conference Committee.

Some in-service training of Elementary teaching staff would be necessary, as few teachers have much background in chess, and most have great fear of chess. But the rules are not difficult and can be learned quickly. Inexpensive beginners' books on basic strategy are available and appropriate for the elementary level. Students who "catch on" and want more instruction can find it at a high school club or a local adult club. Additional practice is available at weekend tournaments, some which are scholastic tournaments that offer school trophies.



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