

A link between chess and math?

by

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Aims:

- Evaluate effects of primary school chess teaching
- Analyse relationships between chess arithmetic skills

METHOD

- Quasi-experimental design
- Year 1: One Grade 1 and one Grade 2 pair recruited
- Year 2: One Grade 1 pair recruited
- Year 3: One Grade 1 pair recruited

- Pretest in autumn year 1, 2 and 3 and posttests at the end of each of the three academic years

Design

Year 1

Year 2

Year 3

Gr1&2 Pr Po

Po

Po

Gr1

Pr Po

Po

Gr1

Pr Po

Pr=Pretest

Po=Post-test

Subjects and attrition

- Four intervention and four control classrooms with a total of 89 intervention and 89 control students
- Low rate of attrition (13 students)

Tests

- Tests of reading and visuospatial IQ
- One numeral writing test: “Write the digits 0 to 9”,
“Write the number one hundred and five in digits”
- Two number series tests: one forward and one backward jump test
- Two subtraction tests: one mental calculation test and one calculation “with aids” (paper and pen or counters)
- Chess: Test of chess skill and questionnaire on chess activities
- Individual interviews on subtraction solution procedures

RESULTS

1. Pre- to post-test changes

- Separate analyses of covariance for the classroom pairs participating one year, two years and three years
- Strong and increasing intervention-control differences in chess results (T 1, p 7)
- No effects on the reading, visuospatial and arithmetic tests (T 1, p 7)

2. Psychometric analyses:

Correlations between chess and the seven tests by year and experimental/control

- No effects for reading and visuospatial IQ
- Arithmetic tests in control classrooms:
Increasing correlations from pretest to year 1
then decreasing correlations (T 2, p 8)
- Arithmetic tests in intervention classrooms:
Increasing correlations by year (T 2, p 8)

3. Analyses of subgroups within classrooms

- The students in each classroom were subdivided into (6) high-score chess students and the remaining students – low-score
- Analyses of variance were run on: pretest result and post-test results for those participating one year in project, two years in project and three years in project. Two independent variables: high vs low-score students and experimental vs control groups

Results of analyses of variance

- Chess: High-score better than low-score; experim. students score higher than control; significant interaction at final posttest (T 3, p 10)
- Reading and visuospatial IQ: no effects
- Arithmetic tests: no differences at pretest; high-score students score higher than low-score at all posttests for almost all five tests; no interaction between High/Low score students and Experim./Control classrooms

4. Reanalysis of arithmetic tests

- The results on the final posttest for the two arithmetic tests were collapsed and the problems subdivided into an "easy" and "difficult" category
- Separate **t**-tests were run within each classroom between the high- and low- score students.
- The high-score students in two experimental and one control classroom solved a greater number of difficult problems than the low-score students

(T 4, p 11)

5. Analysis of chess test results at final post-test

Categorizations:

21 items in the total test

- 6 tested "Facts" (notations for chessboard squares, rules for piece movements);
- 6 were "Simple" problems (Mate in one);
- 9 were "Advanced" problems (Find a good move for white & Mate in two).

Chess test results

- The high-score experimental students entering the project as a Grade 2 classroom were outstanding on Advanced problems (T 5, p 5)
- The control students solved almost none of the Advanced problems
- In the control classrooms the high-score control students were outstanding on the Simple problems
- Performance increased from pretest to year 1 and then levelled off for the control and for the experimental low-score students

6. Chess questionnaire

Given final autumn to Grade 2, 3 and 4

Questions on:

- In-school informal chess activities
- After-school informal chess activities
- Chess club membership and play in chess club
- Participation in tournaments

Questionnaire results

- The Grade 2 high-score students very active
- The Grade 2 low score students inactive
- Much smaller differences between low- and high-score students in (Grade 2 and 3) the Grade 1 classrooms entering the project the first and second year (T 6, p 14)

Does this indicate a split between the high- and low-score students in the classroom entering the project as a Grade 2?

Psychological analysis

- The results suggest that a link is formed between chess and arithmetic when level of skills has reached certain thresholds
- For arithmetic: the child should master the mental number sequence
- For chess: the child should be able to solve simple problems (Adv. Problems level 2?)
- The link: the ability to immediately perceive meaningful relationships

Didactic analysis

- Chess: splits should be monitored and counteracted.
Goal: to be able to solve Simple problems
- Arithmetic: Stronger emphasis on the formation of the mental number sequence by practicing number series and numeral writing tasks and
- Practicing the jump method solution procedure