Literature Review of Chess Studies

By Anna Nicotera and David Stuit, Basis Policy Research (November 2014)

Executive Summary

Many students in the United States participate in after-school chess clubs. While students join chess clubs for competitive play, there is a growing trend to develop and implement a scholastic chess curriculum that targets students' academic outcomes through after-school and in-school initiatives. Scholastic chess instruction uses chess as a springboard to work on cognitive and academic skills that are critical to student performance, such as logical and spatial thinking, reasoning, long-term planning, assessment, decision-making, memory, judgment, and strategizing. The research base that explores whether chess programs impact student cognitive, academic, and behavioral outcomes is growing. The over-arching goal of this literature review is to identify the degree to which existing empirical evidence supports the theory that participation in chess programs, whether designed as in-school or after-school programs, will lead to improved academic, cognitive, and/or behavioral outcomes for school-aged children.

This literature review identified 51 studies of chess. Twenty-four of the 51 studies met a set of pre-determined criteria for eligibility and were included in analyses. Results from the literature review were categorized by the quality of the study design and organized by whether the studies examined after-school or in-school chess programs.

Tier I:	Experiment that controls for differences by random assignment at student, classroom, or school-level; OR Quasi-experiment that controls for differences in groups by matching on student characteristics AND reports group equivalence on pretest results
Tier II:	Quasi-experiment that controls for differences in groups by matching on student characteristics BUT does not show group equivalence on pretest results
Tier III:	Comparison of chess participants and non-participants, with no controls for differences in groups on pretest results

Results from eligible studies were converted into standardized mean difference effect sizes that allow for the comparison of the magnitude and statistical significance of findings across studies. After pooling effect sizes by outcome measure and type of chess program, the main findings from this literature review are:

1. **After-school chess programs had a positive and statistically significant impact on student mathematics outcomes.**

2. **In-school chess interventions had a positive and statistically significant impact on student mathematics and cognitive outcomes.**

While the two primary outcomes listed above are based on studies that used rigorous research design methodologies (Tier I studies), the results should be interpreted cautiously given the small number of eligible studies that the pooled results encompass (two high-quality after-school studies and seven high-quality in-school studies).

The after-school chess studies examined competitive chess clubs and provided very little detail about how the programs were implemented. On the other hand, the in-school chess studies examined scholastic chess programs and provided some details about the programmatic components. Taken as a whole, the positive mathematics and cognitive outcome results from in-school chess studies may be explained by the chess programs being incorporated into students' weekly academic schedules, instruction during the school day leading to higher attendance rates and lower attrition, administering the program for an extended period of time, and connecting the intervention with math instruction and curriculum.

Theoretically these in-school scholastic chess programmatic components could be implemented in an after-school chess program format. In fact, research on effective after-school programs suggest characteristics that are similar to the components of the in-school chess programs: specific goals, structured content based on sound instructional techniques, and high student attendance. An after-school scholastic chess program that was designed to mimic in-school chess could potentially demonstrate large effect sizes. The pooled effect size in mathematics performance in this literature review for in-school studies was 0.395, which would be comparable to large-scale educational interventions in the United States.

The table presents all of the data collected and coded from the 24 eligible chess studies in this literature review, sorted by the study design classification Tier. The table includes each study's intervention type, sample size, age of children in the sample, study location, outcome measures (with name of assessment in parenthesis), and the Hedge's *g* effect sizes with confidence intervals for each of the outcome measures reported in the study. Effect sizes by outcome measure may include results pooled from multiple findings. C.I. indicates confidence interval for the effect size. A complete bibliography of the eligible studies can be found in the full report.

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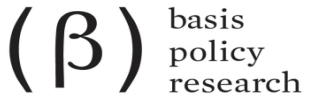

This report was commissioned by the Chess Club and Scholastic Center of Saint Louis. The full report can be downloaded from *http://londonchessconference.com/wp-content/uploads/2014/11/CCSCSL-Literature-Review-of-Chess-Studies-November-20141.pdf*

Table: Eligible chess studies

Study		A	B	C	D	E	F	Age	Outcome Measures	Hedge's g Effect Size (C.I.)
Christiaen (1976)	Belgium	A	I	B	42	2Y	20 v 17	5th-6th grade	Academic, Math & Reading DGB)	Academic, Math: 0.280 (-0.370, 0.930) Academic, Reading: 0.410 (-0.243, 1.063)
Fried & Ginsburg (n.d.)	New York	S	I	BG	18	1Y	10 v 10	4th-5th grade	Cognitive (WISC-R) Behavioral (Survey of School Attitudes)	Cognitive: 0.070 (-0.560, 0.700) Behavioral: 0.103 (-0.774, 0.980)
Hong & Bart (2007)	South Korea	S	I	BG	12	1Y	18 v 20	8-12 years old	Cognitive (TONI-3 & RPM)	Cognitive: 0.172 (-0.280, 0.624)
Kakemi, Yektayar, & Abad (2012)	Iran	S	I	B	?	6M	86 v 94	5th, 8th, 9th grade	Academic, Math (Author) Cognitive (Unknown)	Academic, Math: 0.686 (0.385, 0.987) Cognitive: 0.819 (0.514, 1.123)
Romano (2011)	Italy	S	I	BG	25	1Y	950 v 806	3rd grade	Academic, Math (Author)	Academic, Math: 0.340 (0.245, 0.434)
Sallon (2013)	England	S	I	BG	30	1Y	201 v 282	2nd grade	Academic, Math (Author)	Academic, Math: 0.515 (0.331, 0.699)
Scholz, Niesch, Steffen, Ernst, Loeffler, Witruk, & Schwarz (2008)	Germany	S	I	BG	30	1Y	31 v 22	Elem school	Academic, Math (Author)	Academic, Math: 0.204 (-0.344, 0.752)
Van Zyl (1991)	South Africa	A	I	BG	?	?	80 v 80	5th-10th grade	Academic, Math (Unknown)	Academic, Math:0.640 (0.322, 0.958)
DuCette (2009)	US-PA	A	II	BG	?	?	151 v 151	3rd-8th grade	Academic, Math & Reading (PSSA)	Academic, Math: 0.358 (0.131, 0.585) Academic, Reading: 0.249 (0.023, 0.475)
Hermelin (2004)	South Africa	A	II	BG	?	?	38 v 38	5th-7th grade	Academic, Math (End-of-Course Grades)	Academic, Math: 0.840 (0.371, 1.309)
Aciego, Garcia, & Betancort (2012)	Spain	A	III	BG	30	1Y	170 v 60	6-16 years old	Cognitive (WISC-R) Behavioral (TAMAI)	Cognitive: 0.388 (0.478, 0.299) Behavioral: -0.471 (-0.371, -0.570)
Barrett & Fish (2011)	Texas	S	III	BG	30	1Y	15 v 16	6th-8th grade	Academic, Math (TAKS & End-of-Course Grades)	Academic, Math: 1.428 (0.867, 1.989)

Study		A	B	C	D	E	F	Age	Outcome Measures	Hedge's g Effect Size (C.I.)
Eberhard (2003)	Texas	S	III	BG	60	3M	60 v 77	7th-8th grade	Cognitive (CogAT & NNAT)	Cognitive: -0.085 (-0.251, 0.081)
Ferguson (n.d.)	US-PA	S	III	BG	32	1Y	15 v 79	7th-9th grade	Cognitive (Watson-Glaser & Torrence Tests)	Cognitive: 0.782 (0.384, 1.181)
Forrest, Davidson, Shucksmith, & Glendinning (2005)	Scotland	A	III	BG		1Y	18 v 18	3rd grade	Academic, Reading (Neale) Cognitive (WISC-R) Behavioral (Bristol)	Academic, Reading: -0.004 (-0.466, 0.458) Cognitive: 0.613 (-0.055, 1.281) Behavioral: 0.400 (-0.260, 1.060)
Garcia (2008)	Texas	A	III	BG	30	1Y	27 v 27	5th grade	Academic, Math & Reading (TAKS)	Academic, Math: 1.455 (0.855, 2.055) Academic, Reading: 1.436 (0.838, 2.034)
Kramer & Filipp (n.d.)	Germany	S	III	BG	120	4Y	84 v 83	Elem school	Cognitive (Unknown) Behavioral (Unknown)	Cognitive: 0.673 (0.452, 0.894) Behavioral: 0.267 (0.088, 0.447)
Liptrap (1998)	Texas	A	III	BG	?	?	23 v 269	5th grade	Academic, Math & Reading (TAAS)	Academic, Math: 1.134 (0.698, 1.570) Academic, Reading: 0.609 (0.180, 1.038)
Margulies (1992)	New York	A	III	BG		2Y	22 v 1,118	Elem school	Academic, Reading (DRP)	Academic, Reading: 0.422 (0.000, 0.844)
Rifner (1992)	Indiana	S	III	B	30	1Y	8 v 10	7th grade	Academic, Math & Reading (CTBS/4)	Academic, Math: 0.169 (-0.762, 1.100) Academic, Reading: 0.143 (-0.788, 1.074)
Sigirtmac (2012)	Turkey	S	III	BG	?	?	50 v 50	6 years old	Cognitive (Unknown)	Cognitive: 1.600 (1.150, 2.050)
Thompson (2003)	Australia	A	III	B	30	1Y	64 v 444	6th-12th grade	Academic, Science (Author)	Academic, Science: 0.128 (-0.134, 0.390)
Trinchero (n.d.)	Italy	S	III	BG	15	1Y	412 v 156	3rd-7th grade	Academic, Math (Author)	Academic, Math: 0.421 (0.228, 0.613)
Yap (2006)	Oregon	A	III	BG	30	2Y	233 v 88	3rd-5th grade	Academic, Math & Reading (OR) Behavioral (Cooper-smith & Student Behavior)	Academic, Math: 0.276 (0.030, 0.522) Academic, Reading: 0.152 (-0.093, 0.397) Behavioral: -0.018 (-0.191, 0.155)

A=in-school (S) or after-school (A), B=tier, C=gender(Boys, Girls) D=number of lessons, E=duration, F=number in chess v number in control group