Our Move: Using Chess to Improve Math Achievement for Students Who Receive Special Education Services

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PAIRINGS

Agenda

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  - Purpose of the Study
- Middle Game
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OPENING

Context of the Study

Educational Reform and the Impact on Special Education

- *No Child Left Behind Act of 2001* (NCLB)
- Federal and State Accountability
- High-stakes Testing
  - Impact on middle school level education
  - Impact on students who receive special education services
- Preparing all students for the workplace demands of the 21st century
  - Need for critical thinking, problem-solving, communication, & adaptation
  - Content knowledge as a means to an end - to engage deeper thinking
  - Use of academic skills in a social context to solve complex problems

OPENING

Purpose of the Study

- This study evaluated the use of chess instruction as a tool for sequential transfer within middle school level special education math classes and assessed its impact on the students' math achievement as measured by:
  - End-of-year course grades
  - The *Texas Assessment of Knowledge and Skills* (TAKS) scale scores
  - The TAKS percentage scores by objective

MIDDLE GAME

Review of the Literature

- Adversities faced by students receiving special education services
  - Struggles in traditional classroom
  - As students who receive special education services transition from elementary to secondary schools, a majority are ill-prepared for the dramatically increased demands on their ability to learn subject matter and utilize higher order thinking
    - Barkley (2007), Bulgren, Deshler, & Lenz (2007)
    - Deshler, et al. (2004), Mastropieri et al. (2006)
  - Achievement Gap – See Table 1
    - Center on Education Policy (2009)
    - TEA (2003, 2004, 2005, 2006, 2007, 2008, 2009)
- Successful Interventions
  - Hands-on/activity-oriented/inquiry-oriented
    - Mastropieri, Scruggs, Magnusen (1999), Mastropieri, et al. (2006)
  - Teaching skills and strategies
    - Bulgren, et al. (2006), Deshler, et al. (2001), Smith & Luckasson (1992)

Table 1

Average Percentage of Students Meeting Math TAKS Standards from 2003 to 2009 (English version, First Administration Only)

Grade	Overall	Students in Special Education	Achievement Gap
3	85.6	79.6	-6.0
4	86.0	79.0	-6.7
5	84.0	74.6	-9.4
6	79.4	61.9	-16.1
7	74.1	53.3	-19.4
8	72.0	49.0	-23.0
9	62.6	32.9	-29.7
10	65.6	33.6	-32.0
11	79.4	44.0	-35.4

Data retrieved from AEIS state reports

TEA (2003, 2004, 2005, 2006, 2007, 2008, 2009)

MIDDLE GAME

Review of the Literature

The Game of Chess

- Research in cognitive psychology
- Problem-solving in chess
  - Gobet & Simon (1996), Leamnson (2000), Stevens (2008)
- Chess in education
  - Christiaen (1976), Frank & D'Hondt (1979)
  - Benson (2006), Gobet & Campitelli (2006), McClain (2008)
- Chess with special populations
  - Eberhard (2006), Hong & Bart (2007), Scholz, et al. (2008)
  - Smith & Cage (2000), Storey (2000)
- Chess and mathematics
  - Ho (2006), Langen (1992), Robitaille (1974), Root (2008)

Transfer

- Low Road, High Road, & Sequential
  - Perkins & Salomon (1989), Scholz, et al. (2008)
  - Chi, Glaser, & Rees (1981)
  - Rifner (1992)

MIDDLE GAME

Method of Procedure

1. Only students who received special education services enrolled in resource math classes who took the TAKS, TAKS-A, or TAKS-M test in 2008 and in 2009 were participants in this study.

2. This study was constrained to two middle schools comprised of 6^{th}, 7^{th}, and 8^{th} grades located in a suburban public school district within a southwestern state.

3. Only scores for students who were enrolled as of October 31, 2008 through the end of the school year June 5, 2009 were examined.

MIDDLE GAME

Method of Procedure

- Design: Quantitative, Causal Comparative (Gall, Gall, & Borg, 2007)
  - Independent Variable
    - Chess instruction
      - derived from the works of Kasparov Chess Foundation, David MacEnulty, Alexey Root
    - One class period a week for 30 weeks
  - Dependent variables
    - End-of-year course grades
    - TAKS scale scores
    - TAKS percentage scores by objective
      - Numbers, operations, and quantitative reasoning
      - Patterns, relationships, and algebraic reasoning
      - Geometry and spatial reasoning
      - Concepts and measurement
      - Probability and statistics
      - Mathematical processes and tools

MIDDLE GAME

Method of Procedure

- Instrumentation
  - End-of-year course grades assigned by teachers
  - TAKS, TAKS-A, TAKS-M
- Data Collection
  - Data collected by campus registrars
  - Coded for anonymity
- Sample
  - Scores from 2008 and 2009
  - Students enrolled from October 31, 2008 - June 5, 2009
- Procedures
- Data Analysis
  - One way ANCOVA
  - Adjusted mean scores for treatment and comparison groups
    - Grade level as covariate
    - Pretest scores as covariate

MIDDLE GAME

Presentation of Data

- Participants
  - A total of 31 middle-school students
    - Comparison campus = 16 students
    - Treatment campus = 15 students
  - Grade levels
    - Comparison campus
      - 6th graders = 2 students
      - 7th graders = 8 students
      - 8th graders = 6 students
    - Treatment campus
      - 6th graders = 4 students
      - 7th graders = 6 students
      - 8th graders = 5 students

- See Table 2

Table 2: Demographics of Participants

	Comparison (n=16)	Treatment (n=15)	Total (n=31)
Female	6 (38%)	5 (33%)	11 (35%)
Male	10 (63%)	10 (67%)	20 (65%)
African American	5 (31%)	5 (33%)	10 (32%)
Hispanic	5 (31%)	4 (27%)	9 (29%)
White	6 (38%)	6 (40%)	12 (39%)
Economic Disadvantaged	10 (63%)	6 (40%)	16 (52%)
Other Health Impaired	4 (25%)	6 (40%)	10 (32%)
Auditory Impaired	1 (6%)	0 (0%)	1 (3%)
Emotional/Behavioral Disorder	0 (0%)	2 (13%)	2 (6%)
Specific Learning Disability	11 (69%)	5 (33%)	16 (52%)
Autism	0 (0%)	2 (13%)	2 (6%)

Table 3: Adjusted Mean Scores for 2009 Measures of Math Achievement

Measure	Comparison	Treatment	*F*	Significance	Partial η2
Final Grade	80.61	88.02	19.398*	p < 0.001	0.418
TAKS Scale Score	2084.75	2191.67	9.167*	p = 0.005	0.253
TAKS Objective 1	36.39	55.32	7.167*	p = 0.012	0.210
TAKS Objective 2	44.56	46.80	0.860	p = 0.772	
TAKS Objective 3	46.94	59.12	2.368	p = 0.135	
TAKS Objective 4	50.82	59.80	1.447	p = 0.239	
TAKS Objective 5	45.71	67.38	7.321*	p = 0.012	0.213
TAKS Objective 6	47.94	63.26	3.990	p = 0.056	

ENDGAME

Conclusions and Discussion

- Conclusions by hypothesis
  - Hypothesis 1 is supported
  - Hypothesis 2 is supported
  - Hypothesis 3
    - Supported on objectives 1 & 5
    - Not supported on objectives 2, 3, 4, 6
- Discussion
  - The loss of regular mathematics lessons could, in the very least, be compensated by the chess lessons.
  - Implementation of chess lessons proved feasible
  - Transfer
  - Generalizability is limited due to nature of study

ENDGAME

Limitations

1. There was no random assignment

2. SES, gender, & ethnicity were not controlled

3. The study was limited to only two middle schools.

4. The sample size was relatively small consisting of 31 participants (16 for the comparison campus and 15 for the treatment campus).

ENDGAME

Implications & Significance

This study, the first known of its kind in this country:

- has practical and research implications for special education services and for the use of chess instruction in public schools.
- provides empirical support for the use of chess as a pedagogical tool in mathematics education for students who receive special education services.
- provides empirical support for the use of chess as an instructional tool in public education classrooms.
- provides evidence for data-driven decision-making by educational leaders.

REVIEW & ANALYSIS

Recommendations for Future Research

- Replication on a larger scale
  - Random assignment if possible
  - Elementary and high school levels
- Transfer
  - Explore in detail the underlying factors
  - Focus on specific math objectives
- Qualitative and mixed-method designs
  - Affective benefits
  - Social benefits
- Chess curriculum
  - Exploration
  - Development

REVIEW & ANALYSIS

Transfer

- Summary
- Concluding Video
- Q & A

- *Thank you for your time and attention.*