Educational Benefits of Chess - Brief Review of Academy Literature

Except from AMERICA'S FOUNDATION FOR CHESS RESEARCH STUDY
(October 1, 2008 – September 30, 2009)

Chess has long been recognized throughout the world as a builder of strong intellects, but only recently has educators in the USA begun to recognize chess's ability to improve the cognitive abilities, rational thinking, and reasoning of the least promising children (Marjoram, 1987; Palm, 1994).

Chess brings out latent abilities that have not been reached by traditional educational means. It promotes logical thinking, instills a sense of self-confidence and self-worth, and improves communication and pattern recognition skills. It teaches the values of hard work, concentration, objectivity, and commitment.

Chess and Cognitive Development

In the 1960's, psychologist Adrian de Groot, became very interested in the use of chess as an educational tool. He began studying the thinking behavior of chess players in Russia. In particular, he observed that there was a significant difference in approach between those who were highly skilled and experienced in chess and those who were new to the game.

Initially de Groot assumed that the Grandmasters' superiority lay in their ability to organize well and to memorize concrete lines of play. What de Groot found was quite different—Grandmasters did not rely on superior memory skills. They were not any better at recalling randomly placed pieces than novice chess players were. However, the Grandmaster was able to take actual chess positions, and in an astonishing five seconds, recognize a complex chess configuration and decide on a successful move. How were the Grandmasters able to give accurate, well thought out evaluations in so little time? It seemed that Grandmasters (but not novices) were able to recognize familiar configurations and associate them with appropriate moves and plans.

Recent research in the late seventies and early eighties in the United States has confirmed these findings (Ferguson, 1986; Vail, 1995; Bell, 1972). Researchers concluded that meaningful knowledge is stored in memory in the form of networks and patterns, and these patterns provide the roots essential for recall. Thus, the expert and Grandmaster players were able to remember and recognize two chunks of information.

In chess these chunks are visual representations in which particular configurations are recognized. These relate to, and often cue, prior successful responses or pattern responses. What is an involved, long sequence of decision making of information for novices, is processed by experts in "one go."

It seems that other experts such as dancers, athletes, and musicians operate mentally in much the same way. Responses are efficient and fast as understanding and experience are recognized and recalled in the essential structure of the activity. It seems that chess players develop complex but efficient structures for memory storage and management.

Many twentieth century educators, parents, and chess experts maintain that chess education improves a host of mental abilities, including abstract reasoning and problem-solving (Schmidt, 1982; Rifner, 1997).

Artise (1993) argues that "the game of chess makes one of the most important contributions to the field of education. Inherent in it is [sic] the basic principles of psychological learning theory: memory, pattern recognition, decision-making, and reinforcement."

Peter Shaw, a computer science and chess teacher in Pulaski, Virginia, stated, "The game demands both inductive and deductive reasoning. You see the kid looking at a problem, breaking it down, and then putting the whole thing back together. The process involves recall, analysis, judgment, and abstract reasoning." (Graham, 1985).

As Vail (1995) points out, "Chess, it seems, possesses a rare quality: Children enjoy it despite the fact it's good for them."

Links Between Chess and Academic Performance

Are there links between mathematics and chess? Chess players are often considered mathematically oriented and there are obvious similarities, as chess is a game of problem solving, evaluation, critical thinking, intuition and planning—much like the study of mathematics.

Studies have shown that students playing chess have increased problem-solving skills over their peers. Research suggests that while students playing chess learn concepts through physical and visual stimuli and correlate these concepts to cognitive patterns, mathematics in the classroom usually involves only pure symbolic manipulation. Thus there seems to be some evidence to suggest that chess acts as a sort of link in connecting form (symbolic) with understanding (physical and visual) (Marjoram, 1987; Palm, 1994).

In the early 1980's, Faneuil Adams became president of the American Chess Foundation (ACF). Adams was convinced that chess was an excellent learning tool for the adolescent, especially the disadvantaged. The ACF embarked on the Chess in Schools Program which focused on that many students' social habits improved when playing chess. The game allows students of dissimilar backgrounds to integrate with others.

Many disadvantaged or special education students are becoming actively involved in chess

programs as the value of chess as a social tool is further explored. Advocates of chess are hoping that some of New York's gang-related problems will be solved as children and students play chess in their spare time instead of becoming involved with gang-related activities. Thus chess steers youth away from trouble by keeping them off the streets as well as being a useful learning tool for them.

In Marina, CA, an experiment with chess indicated that after only 20 days of instruction, students' academic performance improved dramatically (Palm, 1990). George L. Stephenson, chairman of the Marina Junior High School math department, reported that 55% of students showed significant improvement in academic performance after this brief smattering of chess instruction.

Educators at the Roberto Clemente School (C.I.S. 166) in New York reported that chess had improved not only academic scores, but social performance as well.

In 1988, Joyce Brown, an assistant principal and supervisor of the school's Special Education department, and teacher Florence Mirin, began *America's Foundation for Chess, Research Study 2009* 3 studying the effect of chess on their Special Education students. When the study began, they had 15 children enrolled in chess classes; two years later they had 398.

Studies have also shown that incidents of suspension and outside altercations have decreased by at least 60% since these children became interested in chess (Palm, 1990).

Several benefits accrue from the teaching and promoting of chess in schools:
1) Chess limits the element of luck; it teaches the importance of planning.
2) Chess requires that reason be coordinated with instinct [intuition]; it is an effective decision teaching activity.
3) Chess is an endless source of satisfaction; the better one plays, the more rewarding it becomes.
4) Chess is a highly organized recreation….
5) Chess is an international language….
It can be a lifelong source of interest, amusement, and satisfaction. Chess provides more long-term benefits than most school sports (Hall, pp. 4-5).

Hall goes on to state that proficiency in chess seems to be related to "inherent logic" and "problem solving ability. "The deeper one's understanding of chess, the more it becomes an exercise in sheer intellect," with each game "an original creation" (pp. 6-7).

Horgan (1986) agrees, stating, "teaching children to perform a complex task like chess may give them problem-solving advantages later [in life]" (p. 10).

Schmidt (1982) cites three long-term goals students achieve through chess:

1. Develop analytical, synthetic, and decision-making skills, which they can transfer to real life
2. Learn to engage in deep and thorough chess research which will help them build their confidence in their ability to do academic research
3. Gain insights into the nature of competition which will help them in any competitive endeavor (p. 7)

Chess clearly is a problem-solving tool, an "ideal way to study decision-making and problem-solving because it is a closed system with clearly defined rules" (Horgan, 1988). When faced with a problem, the first step is to "analyze [it] in a preliminary and impressionistic way: sizing up the problem" (Horgan, 1988, p. 3), possibly looking for patterns or similarity to previous experiences.

"Similarity judgments may involve high levels of abstract reasoning" (Horgan, 1988, p. 3). As in mathematics, which might be defined as the study of patterns, pattern recognition in chess is of prime importance in problem solving. After recognizing similarity and pattern, a global strategy can be developed to solve the problem. This involves generating alternatives, a creative process.

A good chess player, like a good problem solver, has "acquired a vast number of interrelated schemata" (Horgan, 1988, p. 3), allowing for good alternatives to quickly and easily come to mind. These alternatives must then be evaluated, using a process of calculation known as decision tree analysis, where the chess player/problem solver is calculating the desirability of future events based on the alternative being analyzed.

Horgan (1988) found that "the calculation may go several to eight or ten moves ahead. This stage requires serious concentration and memory abilities…[or]…visual imagery" (p.4).

Child chess experts were studied by Schneider, Gruber, Gold, and Opwis (1993), and were found able to store larger "chunks" of information, or "pre-stored schema," than were non expert adults, and were able to recall them much faster than the adults when reconstructing a position. Once a suitable alternative for solving the problem is reached and implemented, it can be evaluated.

Chess players, like all good problem solvers, will go back and evaluate the outcome of a solution to increase their level of expertise. "Experts and potential experts want to know, even when they are successful, if there was a better alternative available to them" (Horgan 1988, p.6).

Pattern recognition, calculation, abstract reasoning, concentration, intuition, deduction, visual imagery, analysis and evaluation are factors widely recognized as attributes of intelligence.

Chess has the added benefits of teaching "impatient kids the value of hard work and delayed gratification" (Drummond, 2000) and possibly of channeling anger in a socially acceptable, safe, and controlled environment (Vail, 1995).

Educators at Roberto Clemente School in New York report that after instituting a chess program, "incidents of suspension and outside altercations have decreased by at least 60 percent" (Palm, 1990). For these reasons, educators are adding chess to their collection of effective strategies for reaching resistant or disconnected youth (Kennedy, 1998).

Smith and Sullivan (1997) studied the effects of chess instruction on student's level of field dependence/independence. They define field dependence/independence as "a psychological construct referring to a global versus analytical way of perceiving that entails the ability to perceive items without being influenced by the background" and note that visual perception and problem solving/critical thinking are factors relating to both the field dependence/independence construct and chess playing ability. The study was conducted with a high school Humanities class composed of 11 African-American students who received approximately 50 hours of chess instruction and playing experience. It was found that chess instruction significantly improved field independence in the seven female subjects. There was no significant effect for the four males.

According to Smith and Sullivan, "Field independent individuals…are abstract-analytical in orientation…[and]…are known for solving problems rapidly" (p. 5). The professions of mathematics, medicine, engineering and the physical sciences tend to attract individuals with field independent characteristics, so Smith and Sullivan infer that chess instruction may be beneficial, especially to females interested in pursuing careers in these fields. "Whether or not this [significant effect on increased field independence] translates into greater mathematics achievement as reported by Christian… [was] beyond the scope of this study" (p. 8). The study may be criticized for non-randomness and small sample size.

In a Texas study of 571 regular (non-honors) elementary school students, Liptrap (1998) found that the 67 students who participated in a school chess club showed twice the improvement of 504 non chess players in reading and mathematics standard scores between third and fifth grades on the Texas Assessment of Academic Skills.

In a 1992 New Brunswick, Canada, study, using 437 fifth-graders, split into three groups, experimenting with the addition of chess to the math curriculum, Louise Gaudreau found increased gains in math problem-solving and comprehension proportionate to the amount of chess in the curriculum (Ferguson, 1995, p. 11).

In a Zaire study conducted by Dr. Albert Frank, employing 92 students age 16 to18, the chess-playing experimental group showed a significant advancement in spatial, numerical, and administrative directional abilities, along with verbal aptitudes, compared to the control

group. The improvements held true regardless of the final chess skill level attained (Ferguson, 1995, p. 2).

Though not deemed statistically stable due to some switching of students between the control groups and experimental group, a four-year study in the United States found the chess-playing experimental group consistently outperforming the control groups engaged in other thinking development programs, using measurements from the *Watson-Glaser Critical Thinking Appraisal* and the *Torrance Tests of Creative Thinking* (Ferguson, 1983).

A study by Margulies (1993) using a sub-set of the New York City Schools Chess Program produced statistically significant results concluding that chess participation enhances reading performance.

A *America's Foundation for Chess, Research Study 2009* related study, conducted in two U.S. cities over two years, selected two classrooms in each of five schools. The group receiving instruction in chess and logic obtained significantly higher reading scores than the control groups, which received additional classroom instruction in basic education (reading, math, or social studies). (Margulies, 1993).

The earliest study, produced in 1975, took place in Belgium, where Christiaen, using Piaget's tests for cognitive development, found a chess-playing experimental group of 20 fifth-graders experienced a statistically significant gain in cognitive development (IQ) over a control group, (Ferguson, 1995). The experimental group received 42 hours of chess instruction over the course of one year (sixth grade). Perhaps more noteworthy, they also did significantly better in their regular school testing as well as in standardized testing administered by an outside agency which did not know the identity of the two groups. Quoting Dr. Adrian de Groot: "In addition, the Belgium study appears to demonstrate that the treatment of the elementary, clear-cut, and playful subject matter can have a positive effect on motivation and school achievement generally..." (Ferguson, 1995, p. 3).

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