



By Dr. Robert C. Ferguson

STUDIES

In a 1973-74 Zaire study conducted by Dr. Albert Frank, employing 92 students, age 16-18, 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. [1], [2], [7]

In a 1974-1976 Belgium study, a chess-playing experimental group of fifth graders experienced a statistically significant gain in cognitive development over a control group, using Piaget's tests for cognitive development. 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. Adriaan 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..." [1], [3], [7]

In a 1977-1979 study at the Chinese University in Hong Kong by Dr. Yee Wang Fung, chess players showed a 15% improvement in math and science test scores. [4]

A four-year study (1979-1983) in Pennsylvania found that the chess-playing experimental group consistently outperformed 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. [1], [4], [5], [6], [7], [23]

The 1979-1983 Venezuela "Learning to Think Project," which trained 100,000 teachers to teach thinking skills and involved a sample of 4,266 second grade students, reached a general conclusion that chess, methodologically taught, is an incentive system sufficient to accelerate the increase of IQ in elementary age children of both sexes at all socio-economic levels. [1], [7], [8], [9], [10]

During his governor's teacher grant from the New Jersey State Department of Education, William Levy found that chess consistently (1980-1987) promoted self-esteem after a year of exposure. Many students' self-images improved dramatically. [7], [11]

According to a two-year study conducted in Kishinev under the supervision of N.F. Talisina, grades for young students taking part in the chess experiment increased in all subjects. Teachers noted improvement in *memory*, better organizational skills, and for many increased fantasy and imagination (Education Ministry of the Moldavian Republic, 1985). [1], [7]

In his 1986 pilot study, Dr. Ferguson found that it is possible to enhance achievement by focusing on individuals' modality strengths, creating an individualized thinking plan, analyzing and reflecting upon one's own problem solving processes, sharing his/her thinking system with peers, and modifying the system to integrate other modalities. [1], [7], [12]

During the 1987-88 "Development of Reasoning and Memory through Chess," all students in a rural Pennsylvania sixth grade self-contained classroom were required to participate in chess lessons and play games. None of the pupils had previously played chess. The pupils significantly improved in both memory and verbal reasoning. The effect of the magnitude of the results is strong (η^2 is .715 for the Memory test gain compared to the Norm). These results suggest that transfer of the skills fostered through the chess curriculum did occur. [1], [7], [13]

A 1989-92 New Brunswick, Canada study, using 437 fifth graders split into three groups, experimenting with the addition of chess to the math curriculum, found increased gains in math problem-solving and comprehension proportionate to the amount of chess in the curriculum. [14]

A 1990-92 study using a sub-set of the New York City Schools Chess Program produced statistically significant results concluding that chess participation enhances reading performance. [15], [16], [23]

“Playing Chess: A Study of Problem-Solving Skills in Students with Average and Above Average Intelligence,” a study by Philip Rifner, was conducted during the 1991-1992 school term. The study sought to determine whether middle school students who learned general problem solving skills in one domain could apply them in a different domain. Data indicated that inter-domain transfer can be achieved if teaching for transfer is an instructional goal. [17]

During the 1995-1996 school year, two classrooms were selected in each of five schools. Students ($N = 112$) were given instruction in chess and reasoning in one classroom in each school. Pupils in the chess program obtained **significantly** higher reading scores at the end of the year. It should be noted that while students in the chess group took chess lessons, the control group ($N = 127$) had additional classroom instruction in basic education. The control group teacher was free to use the “chess period” any way he/she wanted, but the period was usually used for reading, math or social studies instruction. The control groups thus had more reading instruction than the chess groups. Even so, the chess groups did better on the reading post-test; therefore, the gains in the chess groups were particularly impressive. [18]

In a 1994-97 Texas study, regular (non-honors) elementary students who participated in a school chess club showed twice the improvement of non-chess players in Reading and Mathematics between third and fifth grades on the Texas Assessment of Academic Skills. [19], [20]

Researchers and educators have questioned what causes this growth. The Venezuelan study claimed: “Chess develops a new form of thinking, and this exercise is what contributes to increase the intelligence quotient.” [10] More recent researchers speculate that it is the growth of new synaptic connections. Chess promotes the growth of dendrites!

Why does chess have this impact? Briefly, there appear to be at least seven significant factors: 1) Chess accommodates all modality strengths. 2) Chess provides a far greater quantity of problems for practice. 3) Chess offers immediate punishments and rewards for problem solving. 4) Chess creates a pattern or thinking system that, when used faithfully, breeds success. The chess playing students had become accustomed to looking for more and different alternatives, which resulted in higher scores in fluency and originality. 5) Competition. Competition fosters interest, promotes mental alertness, challenges all students, and elicits the highest levels of achievement (Stephan, 1988). 6) A learning environment organized around games has a positive affect on students’ attitudes toward learning. This affective dimension acts as a facilitator of cognitive achievement (Allen & Main, 1976). [21] Instructional gaming is one of the most motivational tools in the good teacher’s repertoire. Children love games. Chess motivates them to become willing problem solvers and spend hours quietly immersed in logical thinking. These same young people often cannot sit still for fifteen minutes in the traditional classroom. 7) Chess supplies a variety and *quality* of problems. As Langen (1992) states: “The problems that arise in the 70-90 positions of the average chess game are, moreover, new. Contexts are familiar, themes repeat, but game positions never do. This makes chess good grist for the problem-solving mill.”

FACTS

Chess is part of the curricula in nearly 30 countries. In Venezuela, Iceland, Russia and other countries, chess is a subject in all public schools. [8]

In Vancouver, BC, the Math and Chess Learning Center, recognizing the correlation between chess playing and math skills development, has developed a series of workbooks to assist Canadian students in math. [42]

In Harriet Geithmann's article "Strobeck, Home of Chess," The National Geographic Magazine, May 1931, pp. 637-652, we find that this medieval village in the Harz Mountains of Germany has taught the royal game in its public schools for years. Chess began in Strobeck in 1011. [37]

In "Chessmen Come to Life in Marostica," The National Geographic Magazine, November 1956, by Alexander Taylor, pp. 658-668, we see an Italian town reviving a romantic legend of the Middle Ages, in which suitors played chess for the hand of a lady fair. [43]

The mathematics curriculum in New Brunswick, Canada is a text series called *Challenging Mathematics*, which uses chess to teach logic and problem solving from grades 2 to 7. Using this curriculum, the average problem-solving score of pupils in the province increased from 62% to 81%. The Province of Quebec, where the program was first introduced, has the highest math grades in Canada, and Canada scores better than the USA on international mathematics exams. [19], [20], [40]

Former U.S. Secretary of Education Terrell Bell encouraged knowledge of chess as a way to develop a preschooler's intellect and academic readiness. [39]

The State of New Jersey passed a bill legitimizing chess as a unit of instruction within the elementary school curriculum. On December 17, 1992, New Jersey Governor Jim Florio signed into law a bill to establish chess instruction in public schools. A quote from the bill states "In countries where chess is offered widely in schools, students exhibit excellence in the ability to recognize complex patterns and consequently excel in math and science..." [41]

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 Senate that way, but the phrase was deleted later in Conference Committee. [19]

ANECDOTAL

Several articles discuss chess as a tool to assist children of all levels.

Dr. Stefurak, a cognitive neuropsychologist, stated that "...chess instruction informs the mind and the emotions in such a way as to structure an emergent mental circuit where motivation and ability multiply to produce achievement in chess and school and life. [23]

In December 1996, Arman Tajarobi wrote: "For the past three years, I've been a witness to an experiment held in 24 elementary schools in my town: The school board allowed these schools to replace an hour of math classes by a chess course each week for half of their students. For three consecutive years, the groups who received the chess formation have had better results in maths than those who did not. This year (the fourth year), the school board has allowed any school that wants to provide its students with a chess formation to do so." [35]

John Artise (B.S., M.A.) draws upon his years of psychological research in chess to identify the contribution chess makes in education and learning. He identifies four areas of growth: memory improvement, logic, observation and analysis, and operant conditioning. (K) “*Chess and Education*,” John Artise. [31]

The chess program funded by Oakland (California) Youth at Risk program proves to be an effective vehicle for saving troubled youth. [32]

Chess program in the troubled East Harlem district, New York, also rescues kids from drugs and gangs. [33]

Saratoga Springs editorial: “Chess is the last best hope for this country to rescue its skidding educational system and teach the young generation the forgotten art of nurturing an attention span.” [34]

In his book Your Child's Intellect, former U.S. Secretary of Education Terrell Bell encourages some knowledge of chess as a way to develop a preschooler's intellect and academic readiness (Bell, 1982, pp. 178-179). [44]

WHAT DO EDUCATORS SAY?

“Not only have the reading and math skills of these children soared, their ability to socialize has increased substantially, too. Our studies have shown the incidents of suspension and outside altercations have decreased by at least 60 percent since these children became interested in chess.” --Assistant Principal Joyce Brown at the Roberto Clemente School in New York, 1988 [25]

Dr. Fred Loveland, superintendent of the Panama City schools, voiced his opinion: “Chess has taught my students more than any other subject.” [26]

The article “Chess Improves Academic Performance” from the NY School Chess Program features a number of testimonies from school principals, including: “Not only have the reading and math skills of these children soared, their ability to socialize has increased substantially, too. Our studies have shown that incidents of suspension and outside altercations have decreased by at least 60% since these children became interested in chess.” [27]

“It's the finest thing that ever happened to this school. ...chess makes a difference...what it has done for these children is simply beyond anything that I can describe.” [27]

“I see them (students) able to attend to something for more than an hour and a half. I am stunned. Some of them could not attend to things for more than 20 minutes.” --Jo Bruno, Principal, P.S. 189 [27]

Dr. Calvin F. Deyermond, Assistant Superintendent for Curriculum and Instruction for the North Tonawanda City School District, wrote: “...chess develops intellectual, esthetic, sporting, decision making, concentration, and perseverance skills. We have seen the effects of this wonderful game in our classroom and as an extracurricular activity. Not only is it mentally challenging but it attracts not only gifted pupils but also students at all levels of learning. Many students who have been experiencing problems, particularly in mathematics and reading, sometimes demonstrate remarkable progress after learning chess.” [28]

Rob Roy of Connecticut: “Children with special problems can also learn chess. I taught a successful course for emotionally and educationally disadvantaged children in the Waterbury schools and used chess as a way for them to learn and practice self-control. It was like turning on switches in their heads. You see the child looking at a problem, breaking it down, and then putting

the whole thing back together. The process involves recall, analysis, judgment and abstract reasoning.” [38]

Public School 68 in the Bronx noted standardized scores increased 11.2% in reading and 18.6% in math during the 1994-95 school year. Principal Cheryl Coles wrote: “...as encouraging as our scores are, the benefits of our Chess Education Program far exceeded anything that these scores could ever hope to indicate. There were significant outgrowths in varying degrees in all curriculum areas. Such as: increased enthusiasm for learning, increase in general fund of knowledge, increase in pupil attendance, increase in self-confidence, increase in parent involvement, etc.” [29]

Beulah McMeans, a guidance counselor at Morningside Elementary School in Prince George’s County, MD, uses chess “...to help raise the self-esteem and higher order thinking skills for young students, particularly those at risk.” [30]

“Intuitively, I feel what the kids learn from chess carries over to their everyday lives. The change shows up in their improved critical thinking and problem solving. It gets kids to think for themselves.” --Fred Nagler, Principal, P.S. 123 [27]

WHAT DO STUDENTS SAY?

“Chess has significantly increased my logical and mathematical skills. In fact, because of the effect of chess, I am going to major in mathematics and computer science in college, both of which utilize the aforementioned skills.” --Matthew Puckett [45]

The skills chess offers to those who play it are gold mines. It teaches the faithful players how to approach life. It teaches people that are having dilemmas that there is more than one answer to a problem. While your adversary is looking at the issue through a single point, you as the great chess player that you are, can take a step back and look at the picture through many points.—Sultan Yusufzai [45]

Because of chess, I feel that my life has been enriched both mentally and socially. I have improved my critical thinking skills in everyday life through chess.—Brandon Ashe [45]

WHAT DO PARENTS SAY?

Andrew Rozsa, psychologist, speaking of his gifted son: “He has had real social and behavioral difficulties since he was 18 months old... He was thrown out of several schools... Things became pretty bad at about age 9½ ... Nothing seemed to work, nothing. ... Today he is a straight A student and his behavior problems are minimal (but not trivial). ... Sorry, no control subjects, no double blind, no defined independent variables (actually there are two: chess and age). Nonetheless, I think that the great improvements we have seen are, to a large extent, due to chess.” [36], [38]

Chess is one of the most meaningful things I’ve ever seen enter this school system.—Dee Estelle Alpert I want to see chess introduced into the curriculum, right alongside math, music, and art.—Oscar Shapiro [27]

CONCLUSION

At the 40th World Chess Congress in 1969, Dr. Hans Klaus, Dean of the School of Philosophy at Humboldt University in Berlin, commented upon the chess studies completed in Germany: “Chess helps any human being to elaborate exact methods of thinking. It would be particularly useful to start playing chess from the early school days...Everybody prefers to learn something while playing rather than to learn it formally...it produces in our children an improvement in their school achievements. Those children who received systematic instructions in chess improved their school

efficiency in different subjects, in contrast with those who did not receive that kind of instruction.” [22]

Because of the overwhelming research demonstrating the benefits of chess and because of the brain research theorizing the growth of dendrites, chess should be integrated into the school curriculum at the primary level.

Chess is a new way of solving the old problem of poor education. From the streets of Harlem to Venezuela's public schools the sport of kings has been implemented as an effective tool for teaching students to utilize their higher order thinking skills and to strive to overcome personal problems to reach their full potential. In light of these facts it is not unreasonable to imagine chess as a broader part of schools in America. Chess could very well be one of the missing components for America to regain its place at the top for educating its young people.

NOTES

- [1] Robert Ferguson, “Chess in Education Research Summary,” paper presented at the Chess in Education A Wise Move Conference at the Borough of Manhattan Community College, January 12-13, 1995.
- [2] Albert Frank, “Chess and Aptitudes,” doctoral dissertation, 1974, Trans. Stanley Epstein.
- [3] Johan Christiaen, “Chess and Cognitive Development,” doctoral dissertation, 1976, Trans. Stanley Epstein.
- [4] Donna Nurse, “Chess & Math Add Up,” Teach, May/June 1995, p. 15, cites Yee Wang Fung's research at the Chinese University of Hong Kong.
- [5] Robert Ferguson, “Teaching the Fourth ‘R’ (Reasoning) through Chess,” School Mates, 1(1), 1983, p. 3.
- [6] Robert Ferguson, “Developing Critical and Creative Thinking through Chess,” report on ESEA Title IV-C project presented at the annual conference of the Pennsylvania Association for Gifted Education, Pittsburgh, Pennsylvania, April 11-12, 1986.
- [7] Robert Ferguson, “Teaching the Fourth ‘R’ (Reflective Reasoning) through Chess,” doctoral dissertation, 1994.
- [8] Isaac Linder, “Chess, a Subject Taught at School,” Sputnik: Digest of the Soviet Press, June 1990, pp. 164-166.
- [9] Rafael Tudela, “Learning to Think Project,” Commission for Chess in Schools, 1984, Annex pp. 1-2.
- [10] Rafael Tudela, “Intelligence and Chess,” 1984.
- [11] William Levy, “Utilizing Chess to Promote Self-Esteem in Perceptually Impaired Students,” a governor's teacher grant program through the New Jersey State Department of Education, 1987.
- [12] Robert Ferguson, “Tri-State Area School Pilot Project Findings,” 1986.
- [13] Robert Ferguson, “Development of Reasoning and Memory through Chess,” 1988.
- [14] Louise Gaudreau, “Étude Comparative sur les Apprentissages en Mathématiques 5e Année,” a study comparing the Challenging Mathematics curriculum to traditional math, 1992. (The authors are Michel and Robert Lyons. The ISBN is 2-89114-472-4. This collection has been sold to La Chenelière & McGraw Hill in Montreal. You can reach them at (514) 273-7422. Ask for Michel Solis.)
- [15] Stuart Margulies, “The Effect of Chess on Reading Scores: District Nine Chess Program Second Year Report,” 1992.
- [16] Chess-in-the-Schools, Web page at <http://www.symbolic.com/chess/chsgym.htm>.

- [17] Philip Rifner, "Playing Chess: A Study of Problem-Solving Skills in Students with Average and Above Average Intelligence," doctoral dissertation, 1992.
- [18] Stuart Margulies, "The Effect of Chess on Reading Scores," 1996.
- [19] James Liptrap, "Chess and Standard Test Scores," Chess Life, March 1998, pp. 41-43.
- [20] James Liptrap, "Chess and Standardized Test Scores," Chess Coach Newsletter, Spring 1999, Volume 11 (1), pp. 5 & 7.
- [21] L.E. Allen & D.B. Main, "Effect of Instructional Gaming on Absenteeism: the First Step," The Journal for Research in Mathematics Education, 1976, 7 (2), p. 114.
- [22] Naciso Rabell Mendez, "Report by the World Chess Federation (FIDE) to the United Nations Organization (UNO)," June 1988, quotes Dr. Klaus' comments.
- [23] Kathleen Vail, "Check This, Mate: Chess Moves Kids," The American School Board Journal, September 1995, pp. 38-40.
- [24] Yasser Seirawan, "Scholastic Chess—Feel the Buzz," Inside Chess, February 21, 1994, p. 3.
- [25] Roger Langen, "Putting a Check to Poor Math Results," The Reporter, December 1992.
- [26] Dr. Fred Loveland personal communication.
- [27] Chess Improves Academic Performance, Christine Palm, 1990.
- [28] Personal letter from Dr. Calvin F. Deyermond, Assistant Superintendent for Curriculum and Instruction for the North Tonawanda City School District.
- [29] Personal letter to Allen Kaufman from Principal Cheryl Coles, June 9, 1995.
- [30] Carol Chmelynski, "Chess said to promote school performance and self-esteem," School Board News, July 6, 1993, Vol. 13 (12), pp. 7-8.
- [31] John Artise, "Chess and Education."
- [32] San Jose Mercury News, 4-3-96.
- [33] Jo Coudert, "From Street Kids to Royal Knights," Readers Digest, June 1989.
- [34] "Editorial: Chess gives hope for our youth," The Saratogian, March 12, 1991.
- [35] Arman Tajarobi, e-mail from December, 1996.
- [36] Andrew J. Rozsa, Birmingham, Alabama, Newsgroup e-mail.
- [37] Harriet Geithmann, "Strobeck, Home of Chess," The National Geographic Magazine, May 1931, pp. 637-652.
- [38] "Check Mates," Fairfield County Advocate, Mar. 20, 1989.
- [39] Terrell Bell, Your Child's Intellect, Englewood Cliffs, NJ: Prentice Hall, 1982, pp.178-179.
- [40] Chess'n Math Association, Canada's National Scholastic Chess Organization, 1681 Bayview Avenue, Toronto, Ont. M4G 3C1 (web page at <http://www.chess-math.org/>)
- [41] Dan Edelman, "New Jersey Legislature Passes Chess Bill into Law," Chess Coach Newsletter, Spring 1993, Vol. 6 (1), pp. 1 & 3.
- [42] Math and Chess Puzzle Centre, 3550 West 32nd Avenue, Vancouver, BC V6S 1Z2 (Web page at <http://www3.bc.sympatico.ca/mathchess/>)
- [43] Alexander Taylor, "Chessmen Come to Life in Marostica," The National Geographic Magazine, November 1956, pp. 658-668.
- [44] Terrell Bell, Your Child's Intellect, 1982, pp. 178-179.
- [45] Scholar-Chessplayer Outstanding Achievement Award Applications.

WHY SHOULD YOU PLAY CHESS? WHAT ARE THE BENEFITS?

Source: <http://library.advanced.org/10746/reasons.html>

- Chess is a game for people of all ages. You can learn to play at any age and in chess, unlike in many other sports, you don't ever have to retire. Age is also not a factor when you're looking for an opponent—young can play old and old can play young. Chess develops memory. The chess theory is complicated and many players memorize

different opening variations. You will also learn to recognize various patterns and remember lengthy variations.

- Chess improves concentration. During the game you are focused on only one main goal—to checkmate and become the victor.
- Chess develops logical thinking. Chess requires some understanding of logical strategy. For example, you will know that it is important to bring your pieces out into the game at the beginning, to keep your king safe at all times, not to make big weaknesses in your position and not to blunder your pieces away for free. (Although you will find yourself doing that occasionally through your chess career. Mistakes are inevitable and chess, like life, is a never-ending learning process.)
- Chess promotes imagination and creativity. It encourages you to be inventive. There are an indefinite amount of beautiful combinations yet to be constructed.
- Chess teaches independence. You are forced to make important decisions influenced only by your own judgment.
- Chess develops the capability to predict and foresee consequences of actions. It teaches you to look both ways before crossing the street.
- Chess inspires self-motivation. It encourages the search of the best move, the best plan, and the most beautiful continuation out of the endless possibilities. It encourages the everlasting aim towards progress, always steering to ignite the flame of victory.
- Chess shows that success rewards hard work. The more you practice, the better you'll become. You should be ready to lose and learn from your mistakes. One of the greatest players ever, Capablanca said, "You may learn much more from a game you lose than from a game you win. You will have to lose hundreds of games before becoming a good player."
- Chess and Science. Chess develops the scientific way of thinking. While playing, you generate numerous variations in your mind. You explore new ideas, try to predict their outcomes and interpret surprising revelations. You decide on a hypothesis, and then you make your move and test it.
- Chess and Technology. What do chess players do during the game? Just like computers they engage in a search for the better move in a limited amount of time. What are you doing right now? You are using a computer as a tool for learning.
- Chess and Mathematics. You don't have to be a genius to figure this one out. Chess involves an infinite number of calculations, anything from counting the number of attackers and defenders in the event of a simple exchange to calculating lengthy continuations. And you use your head to calculate, not some little machine.
- Chess and Research. There are millions of chess resources out there for every aspect of the game. You can even collect your own chess library. In life, is it important to know how to find, organize and use boundless amounts of information. Chess gives you a perfect example and opportunity to do just that.
- Chess and Art. In the Great Soviet Encyclopedia chess is defined as "an art appearing in the form of a game." If you thought you could never be an artist, chess proves you wrong. Chess enables the artist hiding within you to come out. Your imagination will run wild with endless possibilities on the 64 squares. You will paint pictures in your mind of ideal positions and perfect outposts for your soldiers. As a chess artist you will have an original style and personality.
- Chess and Psychology. Chess is a test of patience, nerves, will power and concentration. It enhances your ability to interact with other people. It tests your sportsmanship in a competitive environment.

- Chess improves schoolwork and grades. Numerous studies have proven that kids obtain a higher reading level, math level and a greater learning ability overall as a result of playing chess. For all those reasons mentioned above and more, chess playing kids do better at school and therefore have a better chance to succeed in life.
- Chess opens up the world for you. You don't need to be a high ranked player to enter big important competitions. Even tournaments such as the US Open and the World Open welcome players of all strengths. Chess provides you with plenty of opportunities to travel not only all around the country but also around the world. Chess is a universal language and you can communicate with anyone over the checkered plain.
- Chess enables you to meet many interesting people. You will make life-long friendships with people you meet through chess.
- Chess is cheap. You don't need big fancy equipment to play chess. In fact, all you may need is your computer! (And we really hope you have one of those, or else something fishy is going on here.) It is also good to have a chess set at home to practice with family members, to take to a friend's house or even to your local neighborhood park to get everyone interested in the game.
- CHESS IS FUN! Dude, this isn't just another one of those board games. No chess game ever repeats itself, which means you create more and more new ideas each game. It never gets boring. You always have so much to look forward to. Every game you are the general of an army and you alone decide the destiny of your soldiers. You can sacrifice them, trade them, pin them, fork them, lose them, defend them, or order them to break through any barriers and surround the enemy king. You've got the power!

To summarize everything in three little words—*Chess is Everything!*

ADDITIONAL INFORMATION

For additional information about the studies reviewed in this summary, please contact the United States Chess Federation by calling 914-562-8350 or by writing to:

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The USCF web page address is <http://www.uschess.org>

For a list of research available from the USCF: <http://uschess.org/scholastic/sc-research.html>

For a manual and/or a CD ROM on Developing Higher Order Thinking Skills Through Chess, a Pennsylvania State Department of Education approved course, contact the American Chess School at 140 School Street, Bradford, PA 16701 or e-mail amchess@penn.com.