academicJournals

Vol. 11(11), pp. 1056-1063, 10 June, 2016
DOI: 10.5897/ERR2016.2676
Article Number: 5CBB26F58892
ISSN 1990-3839

http://www.academicjournals.org/ERR

Educational Research and Reviews

Full Length Research Paper

An investigation on the effectiveness of chess training on creativity and theory of mind development at early childhood

Ayperi Dikici Sigirtmac

Department of Early Childhood Education, Faculty of Education, Çukurova University, Adana, Turkey.

Received 29 January, 2016; Accepted 23 May, 2016

In recent years, chess training is offered as a compulsory elective course in some pre-schools, whereas it is not offered in some other pre-schools. There are children who attend chess clubs outside of schools. Chess is considered to be a game of intelligence, and its effects on individuals have been the subject of many researches. This study was conducted to investigate whether chess training has any impacts on creativity and theory of mind skills of children. For this purpose, the study was conducted on a total of 87 children including 41 children who received chess training (67.9 months old) and 46 children who didn't receive any chess training (68.46 months old). As a result, the scores of children who had chess training were found to be higher than scores of other children both in creative thinking and theory of mind tests, and the difference between scores of these children were also found to be statistically significant.

Key words: Chess, preschool education, creative thinking, theory of mind.

INTRODUCTION

Chess is a board game for two players. Furthermore, it is a game of intelligence known all over the world with tournaments and championships. Some private schools offer chess courses beginning from preschool. It is offered as an elective course in some state schools. Some private chess clubs provide chess training courses and organize tournaments for children even in preschool. Since chess is a game of intelligence, and it helps developing strategic thinking and problem-solving skills of children, it may also be effective in improving their cognitive skills. Therefore, several studies were conducted to investigate the possible impacts of learning and gaining experience in chess on individuals.

LITERATURE REVIEW

There are several studies conducted to improve student learning by investigating how strategies and skills used in strategic games can be transferred to other learning areas. In this way, researchers determined how these skills were transferred from a game into an academic field to see whether the expected learning goals have been achieved at a certain degree or even higher

E-mail: ayperis@cu.edu.tr.

compared to other instructional strategies.

In a study conducted by Hays (2005), some games used for instruction at multiple levels such as elementary, middle high school and college were examined. According to the results of this study, although the use of games didn't help in improving the scores after instruction, though the same scores were given by other instructional strategies which mean that the advantages of using the games are comparable with the benefits of other strategies. Although the same skills were practiced in the games and other forms of instruction methods, students often preferred playing games. Thus, it can be concluded that learning skills in a game help students to transfer the skills to other areas (Adams, 2012).

Chess helps individuals to enrich problem solving abilities, improve intelligent thinking and enhance strategic thinking skills and even improving self-esteem as well as higher order thinking skills which is also known as meta-cognitive skills. Furthermore, young people evaluate their actions and predict future possibilities while playing chess. In countries, where chess is intensely played by students, practicing students become among the top students in math and science and they are able to recognize complicated patterns (Milat, 1997).

In *Creative Chess (Avni, 1998)*, which is a book written by Amazia Avni who is a psychologist and a chess master, the roots of creativity in human were analyzed. According to him, an intelligent process consists of four different steps as synthesis (opinion forming and plan shaping), gathering (collecting the raw materials during position evaluation), enlightenment (a sudden observation of an idea) and realization (translating the idea into practical lines of play). Thus, these four steps can be used for a creative process that could also work in some other areas (Bushinsky, 2009).

Theory of mind, divergent thinking and creativity

There are various transitions and understanding regarding the developing minds of children (Welman, 1995). The Theory of Mind (ToM), which was proposed by Permack and Woddruff in 1978 for the first time, provides a simple definition:

"The individual imputes mental states to himself and others" (Doherty, 2008).

ToM is correlated with social cognitive skills, and these skills have impacts on understanding beliefs and intensions as well as interpreting the mental state of other people (Li et al., 2013). Most researchers considered that there is a single transition in children's understanding of mental states which was a change they experience between 3 and 4 years of age or a change experienced from before to after an interpreting a false belief (Bartsch and Wellman, 1995).

The first level ToM skills of children is evaluated by appearance-reality, unexpected content and transfer processes. These first level skills start improving from the age of three. In these processes, children are asked to make predictions about their actions after being informed about beliefs and desires of the characters. The second level skills include the skills about multiple mental states and gained around the age of six. In the first level skills, in the task of unexpected content, objects that are very well-known by children are used. In this process, it is considered that realization of wrong beliefs help individuals to guess the beliefs of others (Gopnik and Astingto, 1988). In the process of unexpected-transfer, distinguishing opinions and referring to the state of mind of another person are evaluated (Flavell, 1999).

The development of ToM is a significant factor in the social domain and understanding the self as well as in the utilization of mental capacities of individuals through metarepresentation as it becomes real in the case of divergent thinking. In this way, new ways of using mind can find a change with the help of social intelligence. Transfer of knowledge between different fields and areas is an important factor for creativity and invention of humans (Suddendorf and Fletcher-Flinn, 1997). To refer mental capacities ToM of human, divergent thinking and creativity terms are often used in recent studies. Therefore, the relationship between these concepts should be examined.

Carnevale et al. (1990) describe divergent thinking as "a process for expanding the view of a problem. It involves thinking in different ways about the problem as a whole without necessarily trying to solve it. In divergent thinking, a person tries to connect ideas for which connections are not apparent; the resulting combinations may lead to a previously unsuspected solution to a problem" (Saccardi, 2014). It is easy to contrast divergent thinking with convergent thinking that basically results in correct and traditional ideas and solutions rather than unique options (Runco and Acar, 2012).

The definitions related to divergent thinking are beyond creativity. Creative or divergent thinker is described as the person who pushes the boundaries of ability and knowledge, and able to reconsider the problem to find a different perspective and solution and ignore distractions that can negatively affect his/her productivity (Saccardi, 2014).

Skills such as divergent thinking clearly depend on mental access to one's own mind improve with the acquisition of ToM. In addition, several researchers suggested that metarepresentation is an important factor in creativity. Children who are able to complete false-belief tasks are expected to be much better in divergent thinking tasks compared to other children since they are able to scan knowledge from diverse domains and areas in order to generate divergent and new answers for problems encountered (Suddendorf and Fletcher-Flinn, 1997).

Divergent thinking allows individuals to create testable hypotheses, and make reliable evaluation of creative thoughts. The important idea of evaluating creative thoughts is exploring the potential. Since divergent thinking leads to originality and originality is the key idea of creativity, divergent thinking is not the same as creative thinking. However, although someone may not perform very well in creativity, he/she can do well on a test of divergent thinking (Runco and Acar, 2012).

Creativity can be defined in two ways as the process of rediscovering something which has already been discovered and producing something new (Deroche, 1968). Today, there is a common ground about creativity which implies that "bringing something into being that is original (new, unusual, novel, unexpected) and also valuable (useful, good, adaptive, appropriate)" (Osche 1990). Although creative thinking is a new concept that is discussed in human evaluation, its cognitive basis has a long and evolutionary history. Three foundations of creative thinking largely evolved on an independent basis as a capacity for language, a theory of mind and a complex material culture (Gabora, 2013).

Mithen (1998) suggests that there are cognitive prerequisites required for human creativity as a complex material culture, a theory of mind (ToM) and language that are leading to an improved mind. These cognitive skills can be combined in order to allow emergence of cognitive fluidity that facilitate the production of creative thinking. In this process, the mind brings different concepts together from social, natural history and technical domains (Keenoo, 2014).

In creativity studies, researchers have used some tests. Hocevar (1981) proposed four types of creativity tests as biographical inventories, attitude and interest inventories, divergent thinking tests and personality inventories. Although each test provides useful information, the divergent thinking tests are commonly used in the area of creativity assessment for several decades (Runco and Acar, 2012).

In the literature, the effectiveness of chess were investigated on some topics such as problem solving involving geometric and numeric patterns (Ferreira and Palhares, 2008), reading scores (Margulies, 1991), intelligence (Bilalic et al., 2007; De Bruin et al., 2014), problem solving skills (Erhan et al., 2009), scholastic achievement (Thompson, 2003), entellectual and social-emotional enrichment (Aciego et al., 2012), meta-cognitive ability (Kazemi et al., 2012), spatial concepts (Dikici-Sigirtmac, 2012) and mathematics (Barrett and Fish, 2011; Romano, 2011; Aydın, 2015). Some findings of these researches suggest that chess help improve these skills while some studies conclude that there is a complex relationship between chess and improvement of other skills. The study group consists of individuals at least seven years old in general.

However, the relationship between children's creativity, ToM development and chess training should be investigated on six-year-old children especially, since it is considered to be important for children in their early childhood years. The aim of this study was to investigate whether chess training is effective in the development of creativity and ToM of six-year-old children. The following research questions were tried to be answered:

1. Is there a significant difference between the Torrance Tests of Creative Thinking (TTCT) scores of children who received chess training and who didn't receive chess training?
2. Is there a significant difference between the ToM Test scores of children who received chess training and who didn't receive chess training?
3. Is there a significant relationship between the TTCT scores and ToM Test scores of children who received chess training and who didn't receive chess training?

METHODOLOGY

This study was conducted within the scope of relational screening model that allows us to make screening in the types of comparison and correlation. This model aims to provide information about the presence or degree of change between two or more variables (Karasar, 2012).

Participants

The study was conducted on a total of 87 children including 41 children (Mean=67.9 months and 22 female-19 male) who received chess training, and 46 children (Mean= 68.46 months and 19 female- 27 male) who didn't receive any chess training, respectively. Children received chess training for two hours at each week. The training that was conducted by chess teacher lasted for at least seven months at the early childhood education institution. Gazi Early Childhood Development Assessment Tool (GECDAT) was applied on children to determine whether they had experienced any problems in their development. Children with developmental problems were excluded.

The difference between GECDAT scores of children, who didn't experience any development problems, with and without chess training was analyzed by t-test, and no significant difference was found ($t(85)=1.11$, $p>.05$). According to this result, it can be suggested that the development of all children included in the study meets the expectations according to their age.

Materials

ToM tests (False Belief Task and Appearance-Reality Task), Figural Form A of the Torrance Tests of Creative Thinking (TTCT) and GECDAT were employed as the data collection tools.

Gazi early childhood development assessment tool (GECDAT)

Development of children follows a particular sequence while advancing specific to each child. Therefore, assessing develop-mental status of participant children was needed. GECDAT is a development evaluation tool that can be used to evaluate the development of Turkish children within the range of 0 to 72 months old, and to regulate their educational experiences and for early diagnosis of developmental retardations.

GECDAT consists of four subtests including psychomotor (73 items), cognitive (60 items), language (60 items) and social

development (56 items), and a total of 249 items. Items related to self-care skills are in the social-emotional development subtest. Since there are differences between development levels of children according to their age, the numbers of items vary depending on their age and development areas. This tool can be used to determine development characteristics of children, whether they need specific requirements, detect differences between development levels of them, and provide more detailed diagnostic methods. GECDAT can be used with a standard set of materials and user manual. These materials are used to create a game environment for children, and they are evaluated in this environment. The normative study of the instrument was conducted with 4242 children. The split-half reliability (r= .99) were calculated with the data from 1890 children. While the interrater reliabilities of the age groups varied from 0.88 to 0.99, correlations of the subscale scores with the overall development score were found in the range from 0.81 to 0.98. (Temel et al., 2005). "User Certificate" is required to use the tool.

Torrance tests of creative thinking figural form A (TTCT)

TTCT Figural Form A, which was developed by Torrance in 1966 and adapted to Turkish and validated by Aslan (2001), was used. Figural Form A consists of three subtests as image creation, image completion and parallel lines. Norm based measures of creativity are evaluated within the sub dimensions of fluency, elaboration, originality, abstractness of titles and resistance to premature closure. Criterion based measures are discussed within 12 dimensions. Scores of these three tests are evaluated within the dimensions of emotional expressions, storytelling, movement or activity, exposition of the titles, combining incomplete figures, synthesis of incomplete lines, unusual visualization, internal visualization, extending or exceeding the limits, humor, richness or colorfulness of imagination and fantasy. The total creative score is obtained by adding the score gathered from criterion based measures on norm based measures.

Aslan (2001) has also conducted studies about its translation, adaptation of test items into Turkish, validity and reliability of its adaptation to Turkish. The correlation total figural creativity between English and Turkish test applications was found to be highly significant (r = 0.59). The internal consistency values were between r= 0.38 and r=0.89. The lowest Cronbach's alpha value was found as 0.5 for preschool group while the highest internal consistency was determined as 0.71, respectively. The internal and external validity studies were conducted within the scope of validity studies. Title list, Wechsler Adults Form and Wonderlic Personnel Test (General Aptitude Test) was used for criterion validity, and as a result of the analyses conducted, the test was found to be reliable for all age groups and score types (Aslan, 2001).

ToM tests

“Unexpected content task” (Gopnik and Astington, 1988) and “unexpected-transfer task” tests were applied for ToM (Flavell, 1999). Gum box and stones were used for unexpected content task, while Caillou, Pepe (cartoon character) figures and tennis ball was used for unexpected-transfer task. The lowest score that can be received from tests was 0, whereas the highest score was 4.

Design and procedure

First, the schools offering chess training were identified. Then, schools that are not offering any chess training were identified. The necessary permissions were obtained from both schools and parents. GECDA, TTCT, and ToM Tests were respectively administrated on children. Children with development problems were excluded after administration of GECDA test. Before these tests, children were informed about the study, and volunteers were included in the study group. No child has refused to participate in the study. All applications were performed in a separate room with each child. Suitable tables and chairs were provided for children. It took about 20 min to finish GECDA, whereas 30 min for TTCT and 10 min for the ToM tests, respectively. All instructions at the tests were given by researchers due to the fact that the children are illiterate. The data were collected in April-May.

Data analysis

Children’s GECDA scores were calculated, and t-test was used to test whether there is a significant difference between scores of these two groups. Kolmogrov-Smirnov Test was used to determine whether TTCT and the ToM scores were normally distributed in all study groups. According to this test, TTCT scores were normally distributed, whereas ToM scores were not normally distributed.

Independent samples t-test was used to determine whether there is a significant difference between TTCT scores of those who received chess training, and those who didn’t receive any chess training. On the other hand, Mann Whitney U Test was used to determine whether there is a significant difference between the ToM scores. Spearman correlation analysis was performed to see whether there is a significant correlation between TTCT and ToM scores of children who received chess training, and other children who didn’t receive any chess training.

FINDINGS

The findings of this study, which was conducted to see whether there is a significant correlation between creative thinking and ToM scores of children who received chess training and other children who didn’t receive any chess training, are listed below in the order, and in accordance with sub-goals. T-test was used to determine whether there is a significant difference between TTCT scores of those who received chess training, and those who didn’t receive any chess training. The findings are given in Table 1.

Considering the findings in Table 1, there are statistically significant differences between Resistance to Premature Closure ($t(85)=2.36$, $p<.05$) and Elaboration ($t(85)=4.42$, $p<.01$) scores of the groups in the subscales of TTCT. In addition, there are statistically significant differences between total creativity ($t(85)=4.00$, $p<.01$) scores of children who received chess training and other children who didn’t receive any chess training. The children who received chess training obtained the highest average scores from Elaboration and Fluency, whereas the lowest average scores were obtained from Abstractness of Title. On the other hand, children who didn’t receive any chess training obtained the highest average score from Fluency, and they obtained the lowest score from Abstractness of Title, respectively.

Mann Whitney U Test was used to determine whether there is a significant difference between the ToM scores of children who received chess training and other children who didn’t receive any chess training, and the results are

Table 1. Result of independent samples T-Test between chess player and non-chess player.

Variable		n	M	S	sd	T	P
Fluency	Chess player	41	29.95	8.44	85	1.65	0.103
	Non-chess player	46	26.94	8.58			
Elaboration	Chess player	41	33.49	20.68	85	4.42	0.000**
	Non-chess player	46	18.52	9.44			
Originality	Chess player	41	15.27	4.02	85	1.63	0.108
	Non-chess player	46	13.85	4.11			
Abstractness of title	Chess player	41	2.34	2.31	85	1.39	0.169
	Non-chess player	46	1.72	1.88			
Resistance to premature closure	Chess player	41	10.02	4.25	85	2.36	0.020*
	Non-chess player	46	7.94	4.00			
Total	Chess player	41	91.83	30.03	85	4.00	0.000**
	Non-chess player	46	69.89	20.78			

*The mean difference is significant at the 0.05 level; ** The mean difference is significant at the 0.01 level.

Table 2. Results of Mann Whitney U-Test of ToM tests scores between chess player and non-chess player.

Group	n	Mean of rank	Sum of rank	U	P
Chess player	41	48.67	1995.50	751.50	0.048*
Non-chess player	46	39.84	1832.50		

*The mean difference is significant at the 0.05 level.

given in Table 2.Considering the findings illustrated in Table 2, according to Mann Whitney U-test, there is a significant difference between ToM skills of children who received chess training and other children who didn't receive any chess training (U=751.50, p<.05). Considering the mean ranks, ToM abilities of those who received chess training were found to be higher than abilities of those who didn't receive any chess training. Spearman correlation analysis was performed to see whether there is a significant correlation between TTCT and ToM scores of children who received chess training and other children who didn't receive any chess training, and the findings are given in Table 3.

According to Table 3, there is a positive and significant relationship between children who received chess training in terms of ToM scores and average scores of "fluency" (r=0.475, p<.05), "originality" (r=0.486, p<.05), "resistance to premature closure" (r=0.377, p<.05) subscales of TTCT and Total TTCT (r=0.414, p<.05). The relationship between the ToM Scores, subscale and total scores of TTCT of children who didn't receive any chess training was not found to be significant (p>.05).

In addition, a positive and significant relationship was found between ToM scores and average scores of "fluency" (r=0.307, p<.05), "originality" (r=0.282, p<.05), "abstractness of title" (r=0.280, p<.05) subscales of TTCT and total TTCT (r=0.303, p<.05) of all children included in the study. In conclusion, a positive and significant moderate uphill (positive) relationship was found between TOM and TORRANCE total scores of children who received chess training (r=.414, p<.01), and there is no significant relationship found between total scores of children who didn't received any chess training (r=.041, p>.05).

DISCUSSION

In this section, the findings related to creative thinking and the ToM skills of children in both groups were discussed. The generalizations obtained from this study are limited by the sample size of the study. Discussions should be evaluated within these limitations.

In this study, a statistically significant difference was

Table 3. Correlation between TTCT scores and ToM test scores of chess player and non-chess players.

Group			TTCT					
			Fluency	**Elaboration**	**Originality**	**Abstractness of title**	**Resistance to premature closure**	**Total**
ToM tests	Chess player	r	0.475	0.260	0.486	0.204	0.377	0.414
		p	0.002**	0.100	0.001**	0.200	0.015*	0.007**
		n	41	41	41	41	41	41
	Non-chess player	r	0.099	-0.069	0.121	0.288	-0.052	0.041
		p	0.512	0.650	0.425	0.052	0.733	0.785
		n	46	46	46	46	46	46
	Total	r	0.307	0.172	0.282	0.280	0.182	0.303
		p	0.004**	0.112	0.008**	0.009**	0.092	0.004**
		n	87	87	87	87	87	87

*The mean difference is significant at the 0.05 level; ** The mean difference is significant at the 0.01 level.

found between elaboration, resistance to premature closure and total TTCT scores of children in favor of those who received chess training. Creative thinking is a skill that can be found in all individuals, and it can be improved. Children face problems constantly while playing chess. They have to be creative while seeking solutions and planning to reach the target. Children playing chess can find a chance to improve their creative thinking skills by either themselves or instructions of their teachers. As a result of the study, considering both groups, abstractness of title has the lowest average score among creative thinking skills. The highest average score of children who received chess training was obtained from Elaboration and fluency, whereas the highest average score of children who didn't receive any chess training was obtained from fluency.

This result is consistent with findings of Aslan (2001), who adapted TTCT into Turkish, and conducted validity and reliability studies of the scale. The lowest score found in abstractness of titles may be due to the underdeveloped abstract thinking skills of preschool students. Students seem to be weak in finding deeper meanings for the activities, and attribute abstract meanings compared to their creative skills. It is noteworthy that unlike Aslan's (2001) results, Elaboration scores of children who received chess training have the highest average. This finding suggests that children who received chess training pay more attention to details. In chess, it is important to not to overlook the details and consider different perspectives.

In this study, a statistically significant difference was found between the ToM skills of children who received and didn't receive any chess training. This suggests that chess training may have positive impacts on the development of the ToM skills of children. ToM is closely associated with cognitive development. The results of this study are consistent with the results of the experimental study conducted with children aged 6 to 16 years by Aciego et al., 2012. They have concluded that cognitive skills and social-emotional development scores of experimental group playing chess were higher than scores of the control group playing either soccer or basketball in children and adolescents, and the difference was found to be statistically significant.

Most of the studies conducted in the last 20 years evaluate the aspects of cognitive development of children such as ToM and Metacognition (higher order thinking skills). It can be said that there is a direct correlation between ToM and Metacognition. The ToM enables individuals to realize that other people may have different perspectives, understand mental states such as faith, beliefs, desires and knowledge of him/her or others, and have the ability of representing these states mentally. In short, cognitive skill allows individuals to reflect theirs or others' contents of the minds (Goldman, 2012). The child playing chess needs to guess the intention of his/her competitor in each move and think about the possible moves against the move of other player, and also shape his/her next move accordingly. In chess, players should protect themselves in each move, and proceed as planned to win the game. Children may have the opportunity to develop higher-order thinking skills such as ToM while playing chess.

Kazemi et al. (2012) conducted a study with students at various grades to investigate the impact of playing chess on the development of mathematical problem-solving capability and meta-cognitive ability of these students. According to the results of their study, students playing chess have shown better achievement in both mathematical problem solving capabilities and meta-cognitive abilities compared to other students who don't play chess. Furthermore, there was a positive and significant relationship between mathematical problem solving capabilities and meta-cognitive abilities of

students. Therefore, it can be concluded that chess can be used as an effective tool in order to develop the higher order thinking skills of children.

A positive and significant relationship was found between the ToM scores and total average scores of children playing chess obtained from “fluency”, “originality” and “resistance to premature closure” subscales of TTCT and Total TTCT. The relationship between the ToM scores and subscale, and total scores of TTCT of children who didn’t receive any chess training was not found to be significant ($p>0.05$). In addition, a positive and significant relationship was found between ToM scores and average scores of “fluency”, “originality” and “abstractness of title” subscales of TTCT and total TTCT of all children included in the study.

As a result of the study, it can be suggest that both ToM development and creativity of children playing chess is higher than ToM development and creativity of children who don’t play chess. Other studies show that there is a positive relationship between ToM and creativity development of children. Accordingly, Suddendorf and Fletcher-Flinn (1997) have conducted a study entitled “ToM and the Origin of Divergent Thinking” with children aged 3 to 4 years in order to analyze the relationship between creativity and ToM development of these children, and to determine whether children having ToM are better at searching their own minds to find creative answers. In their study, the numbers of appropriate and original answers given in the creativity test were found to be positively correlating with performance on incorrect-belief tasks.

The aim of Sıgırtmac’s (2012) study was to investigate whether chess training would have any impacts on the development of spatial concepts such as between–next to, in front–behind, far–near, corner, diagonal, forward–backward, pattern and symmetry of six-year-old children, and to determine whether there are differences depending on gender of these children. According to the results of Mann Whitney U test, there was a statistically significant difference in all concepts in favor of the children who received chess training. However, there were no differences between these children in any concept depending on their gender. As it can be seen in this study, learning and playing process of chess supports the learning skills of children in other areas.

The results of this study may be an indication suggesting that playing chess may have positive impacts on the development of creative thinking and ToM skills of children.

CONCLUSION AND SUGGESTIONS

As a result; children in the sample group didn’t have any differences in terms of cognitive, language, social-emotional and psychomotor development, whereas creative thinking and ToM skills of children playing chess were found to be significantly different from other children. Chess is considered to be supporting these skills in children. Therefore, offering chess training as a course in all schools for all age groups may support the development of children in many areas. Especially children who are interested in chess may attend to chess clubs. If a similar study is conducted with pretest and posttest model, detailed information about impact of playing chess on the ToM and creative thinking performances of children who are playing and not playing chess may be achieved. Working with larger sample groups may be useful to generalize the information obtained.

Conflict of interests

The author has not declared any conflict of interests.

REFERENCES

Aciego R, Garcia L, Betancort M (2012). The benefits of chess for he entellectual and social-emotional enrichment in school children. Spanish J. Psychol. 15(2):551-559.

Adams TCP (2012). Chess from Square a1: Incorporating chess into the gifted class. Gifted Child Today, 35(4):242-251.

Aslan E (2001). Torrance Yaratıcı Düşünme Testi’nin Türkçe versiyonu. M.Ü. Atatürk Eğitim Fakültesi Eğitim Bilimleri Dergisi, 14:19-40.

Aydın M (2015). Examining the impact of chess instruction for the visual impairment on mathematics. Educ. Res. Rev. 10(7):907-911.

Barrett DC, Fish WW (2011). Our move: Using chess to improve math achievement for students who receive special education services. Int. J. Special Educ. 26(3):181-193.

Bartsch K, Wellman HM (1995) Children talk about the mind. New York: Oxford University Press.

Bilalic M, McLeod P, Gobet F (2007). Does chess need intelligence?- A study with young chess players. Intelligence. 35:457-470.

Bushinsky S (2009). Deus Ex Machina-A higher creative species in the game of chess. AI Magazine. 30(3):63-70. http://dx.doi.org/10.1609/aimag.v30i3.2255

De Bruin ABH, Kok EM, Leppink J, Camp G (2014). Practice, intelligence, and enjoyment in novice chess players: A prospective study at the earliest stage of a chess career. Intelligence. 45:18-25.

Deroche EF (1968). Creativity in the Classroom. J. Creative Behav. 2:4.

Dikici Sığırtmaç A (2012). Does chess training affect conceptual development of 6-year-old children? Early Child Development and Care, 182(6):797-806. http://dx.doi.org/10.1080/03004430.2011.582951

Doherty MJ (2008). Theory of mind: How children understand others' thoughts and feelings. Psychology Press, New York.

Erhan E, Hazar M, Tekin M (2009). Satranç oynayan ve oynamayan ilköğretim öğrencilerinin problem çözme becerilerinin incelenmesi. Atatürk J. Phys. Educ. Sport Sci. 11(2):1-8.

Ferreira D, Palhares P (2008). Chess and problem solving involving patterns. Montana Math. Enthusiast, 5(2&3):249-256.

Flavell JH (1999). Cognitive development: Children’s knowledge about the mind. Annual Rev. Psychol. 50:21-45.

Gabora L (2013). Contextual Focus: A Cognitive Explanation for the Cultural Revolution of the Middle/Upper Paleolithic. http://arxiv.org/ftp/arxiv/papers/1309/1309.2609.pdf

Goldman AI (2012). Oxford Handbook of Philosophy and Cognitive Science (Edited by Eric Margolis, Richard Samuels, and Stephen Stich), http://diabeto.enseeiht.fr/download/perception/Goldman_2012.pdf

Gopnik A, Astington JW (1988). Children’s understanding of representational change and its relation to the understanding of false belief and the appearance-reality distinction, Child Dev. 59:26-37.

Hays RT (2005). The effectiveness of instructional games: Literature review and discussion, (Technical Report No. 2005-004). Retrieved on December, 2014, from file:///C:/Users/pc/Downloads/ADA441935.pdf
Karasar N (2012). Bilimsel Araştırma Yöntemleri, Ankara: Nobel Yayıncılık.
Kazemi F, Yektayar M, Abad AMB (2012). Investigation the impact of chess play on developing meta-cognitive ability and math problem-solving power of students at different levels of education. Procedia-Soc. Behav. Sci. 32:372-379.
Keenoo H (2014). The evolution of creativity. Imaginative Minds: An Interdisciplinary Symposium. http://www.britac.ac.uk/events/imagination/resources/keenoo.htm
Li X, Wang K, Wang F, Tao Q, Xie Y, Cheng Q (2013). Aging of theory of mind: The influence of educational level and cognitive processing. Int. J. Psychol. 48(4):715-727.
Margulies S (1991). The effect of chess on reading scores: District nine chess program second year report. Unpublished manuscript, American Chess Foundation, New York.
Milat M (1997). The role of chess in modern education. Retrieved on December, 2014, from http://southernchessclub.org/site/documents/TheRoleofChessinModernEducation.pdf.
Osche R (1990). Before The Gates Of Excellence: The Determinants Of Creative Genius. Cambridge, UK: Cambridge University Press.
Romano B (2011). Does playing chess improve math learning? Promising (and inexpensive) results from Italy. Unpublished doctoral dissertation, University of Pennsylvania.
Runco MA, Acar S (2012). Divergent thinking as an ındicator of creative potential. Creativity Res. J. 24(1):66-75.
Saccardi MC (2014). Creativity and children's literature : new ways to encourage divergent thinking. Cambridge: University Press.
Suddendorf T, Fletcher-Flinn CM (1997). Theory of mind and the origins of divergent thinking. J. Creative Behav. 31:59-69.
Temel F, Ersoy Ö, Avcı N, Turla A (2005). Gazi Erken Çocukluk Gelişimi Değerlendirme Aracı "GEÇDA". Ankara: Rekmay Ltd. Şti.
Thompson M (2003). Does the playing of chess lead to improved scholastic achievement? Issues in Educ. Res. 13(2):13–26.
Wellman HM (1995). The child's theory of mind. Cambridge, MA: MIT Press.