



## Chess: A game of Kings or the King of Games? A Study of Creativity in Gifted and Non-Gifted Students <sup>1</sup>

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### ABSTRACT

Chess is a game that requires higher order cognitive skills because of its complicated rules. The main goal of this study was to analyse the effect of chess on domain-specific creativities among gifted and non-gifted high-school students. The study was conducted using data of 476 students, including 260 gifted students and 216 non-gifted students. Kaufman Domains Creativity Scale-TR, which was adapted by Şahin (2015b, 2016) into Turkish used data collection instrument. The results of the analysis show that significant differences were obtained among the groups of scholarly, mechanic/ scientific, performance, self/ everyday and art creativities. The findings of the study indicate that the chess-playing is effective in developing creative thinking skills to gifted and non-gifted students.

**Keywords:** Chess, Chess Playing, Creativity Domain, Gifted.

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# Satranç: Kralların Oyunu mu? Oyunların Kralı mı? Üstün Zekalı Olan Öğrenciler ile Üstün Zekalı Olmayan Öğrencilerin Yaratıcılığı Üzerine Bir Çalışma<sup>1</sup>

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## ÖZET

Satranç oyunu kompleks kuralları olan üst düzey düşünme becerileri gerektiren bir oyundur. Bu çalışmanın genel amacı, üstün zekalı olan ve üstün zekalı olmayan lise öğrencilerinin alana özgü yaratıcılıkları üzerinde satrancın etkisinin incelenmesidir. Çalışma, 260'sı üstün zekalı ve 216'sı ortalama zeka düzeyinde olmak üzere toplam 476 öğrenciden dönen veriler ile sürdürülmüştür. Veri toplama aracı olarak Şahin (2015b, 2016) tarafından Türkçeye uyarlanmış olan Kaufman Alanları Yaratıcılık Ölçeği Türkçe Versiyonu kullanılmıştır. Analiz sonuçları akademik, mekanik/bilimsel, performans, öz/günlük ve sanatsal yaratıcılıktan alanlarından oluşan alana özgü yaratıcılık puanlarda gruplar arasında anlamlı farklılıklar olduğuna işaret etmektedir. Çalışma bulguları, satranç oynamanın üstün zekalı olan öğrenciler ile ortalama düzeyde zekaya sahip olan öğrencilerin yaratıcı düşünme becerilerinin geliştirilmesinde etkili olduğuna işaret etmektedir.

**Anahtar Kelimeler:** Satranç, Satranç Oyuncusu, Yaratıcılık Alanları, Üstün Zeka.

## 1. Introduction

Gifted students differentiate cognitively from their peers in terms of their perceptual speed, learning depth and interests (Sak, 2010). Gifted students are more prepared to develop skills such as advanced thinking processes, including creative thinking, compared to their non-gifted peers. Chess may be considered an intellectual game with complex rules and one of the most significant contributions to a school's curriculum for gifted students.

Historically, chess has been the primary domain for psychological studies of human expertise. In 1893, Alfred Binet studied the memory of blindfolded chess players. Sigmund Freud was the first psychoanalyst to discuss the game of chess when, in 1913, he noted that the steps required to master chess were akin to learning psychoanalytic techniques (Ferguson, 1995).

### 1.1. Chess: Intelligence

Chess requires memory skills for many structures particular to the game that may help the player index appropriate moves, formulate action plans and search through the chess problem space in an effective manner. From a theoretical aspect, intelligence could affect skill acquisition in numerous ways. When the same amount of practice is considered, individuals with high intelligence may be able to obtain the accumulation of chess-related structures faster than those with less intelligence. They may also be able to search the problem space faster and more precisely. If this were so, more intelligent individuals might be expected to develop into better players (Waters, Goben & Leyden, 2002).

In studies in which the intelligence components of chess players were analysed, different results were obtained for children and adults. Horgan and Morgan (1990) conducted a study on children and found a correlation of  $r = .34$  between International Performance Ranking System (ELO) and intelligence, and the intelligence scores of those children were higher than average children. In a study conducted on 4226 second-grade students in Venezuela, researchers tested whether chess can be used to develop the intelligence of children as measured by the Wechsler intelligence scale for children (WISC). Participants showed an increase in IQ after less than a year of studying chess. Most students showed a significant gain after a minimum of 4.5 months (Ferguson, 1995).

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Frydman and Lynn (1992) concluded that high-level chess playing requires a good general intelligence and strong visuo-spatial abilities. In their study, which they conducted with 57 children who played chess for four years (age mean=11 years), it was founded that intelligence was among the predictors of chess-playing strength but they found that practising was more important than intelligence. On the other hand, when an elite sub-sample of 23 children was tested, it turned out that intelligence was not a significant factor in chess skill (Bilalic, McLeod & Gobet, 2007a).

Petrowski and Rudik (1927, cited in Grabner, Stern & Neubauer, 2007) performed one of the pioneering studies conducted on adults. They found no evidence between a highly talented group and a control group of adult non-chess players in terms of concentration ability, visuo-spatial memory and general intelligence.

Frank (1978) conducted a study during 1973-1974 in Zaire. The treatment group results indicated that, compared to the control group, there was a significant correlation between the ability to play chess well and high levels of spatial, numerical, administrative-directional and paperwork abilities, as well as verbal aptitudes. Moreover, learning chess had a positive influence on the development of both numerical and verbal aptitudes.

Unterrainer, Kaller, Halsband and Rahm (2006) conducted a study on 25 chess players (1250–2100 ELO) and 25 non-chess players. The study revealed better overall performance in the chess players with increasing differences in more complex planning problems. However, the chess players did not have better fluid intelligence (Raven matrices), memory capacity (digit span) or visuo-spatial working memory than the non-players. In a study by Gliga and Flesner (2014) conducted on 20 (10 control, 10 treatment) novice primary-school students, the effectiveness of chess training for 10 hours on various areas (memory, school performance, etc.) was analysed. In the chess contest held after the training, no effects on IQ level were found.

In another study, Doll and Mayr (1987, cited in Grabner, 2014) investigated adult expert chess players' general intellectual abilities. Twenty-seven chess experts (2220–2425 ELO) were screened using two intelligence tests. Compared with the control group, the chess players had significantly higher IQs. The general intelligence scores of the Berlin intelligence structure test and Cattell's culture fair intelligence test were also significantly higher for the chess experts. However, no significant correlation between the scores in the intelligence tests and the ELO ratings were found. In a study by Grabner Neubauer and Stern (2006) and Unterrainer, Kaller, Leonhart and Rahm (2011), a significant association between chess rating and intelligence could not be established.

Grabner (2014) tested 90 tournament players. A correlation of  $r=.35$ ,  $.38$  and  $.46$ , respectively, was determined for the ELO ratings of the participants and their general, verbal and numerical intelligence within the scope of fluid intelligence. No significant correlation was found with figural intelligence. A significant correlation of  $r=.41$ ,  $.24$ ,  $.45$  and  $.30$  was determined for participants' general, verbal, numerical and figural knowledge within crystallised intelligence.

## 1.2. Chess: Creativity

It can theoretically be said that the two players in a chess game activate cognitive skills within divergent thinking skills, such as fluency, flexibility and originality, as well as creative supporting personality traits, such as overcoming obstacles, risk taking, self-motivation, persistence, and tolerating unexpected occasions and unconventional thinking (e.g Sak, 2009).

The number of studies that have researched the creative thinking abilities of chess players is rather limited. The first was conducted between 1979 and 1982 by Ferguson (1995). The researcher classified the intellectually gifted students with an IQ of 130 or above into three groups: chess treatment, computer treatment and all non-chess treatment combined ( $n=15$  each). Each group met once a week for 32 weeks and most groups spent a total of 60-64 hours pursuing their preferred activity. As a result of the Torrance tests of creative thinking (TTCT), it was determined that the fluency, flexibility and originality scores differentiated on behalf of the chess treatment group. The most significant growth was in originality.

Relationships between personality traits supporting creativity and chess-playing strength have been analysed in two different studies. Grabner, Stern and Neubauer (2007) studied 90 adults and the relationship between personality profile (NEO-FFI) and ELO (ELO scores from 1311 to 2387). As a result,

no significant relationship was found in any dimensions including neuroticism, extraversion, openness to experience, agreeableness and conscientiousness. Bilalic, McLeod and Gobet (2007b) investigated personality profiles using the “Big five” model of 219 young children who played chess and 50 of their peers who did not. As a result of the study, no significant relationship was found between the two groups in terms of extraversion/energy, agreeableness, conscientiousness, emotional instability and intellect/openness. However, a sub-sample of 25 elite players had significantly higher scores for intellect/openness than their weaker chess-playing peers. Furthermore, children who scored higher on intellect/openness and energy/extraversion were more likely to play chess while children who scored higher on agreeableness were less likely to be attracted to chess.

In the research conducted on different groups other than chess players, positive correlation was found among divergent thinking, openness (Furnham, Batey, Anand, & Manfield, 2008; Furnham & Bachtiar, 2008; Sanchez-Ruiz, Hernandez-Torrano, Perez-Gonzalez, Batey, & Furnham, 2011; Soldz & Vaillant, 1999) and extraversion (Batey, Chamorro-Premuzic, & Furnham, 2009; Furnham, Batey, Anand, & Manfield, 2008; Furnham & Bachtiar, 2008); non-significant correlation between agreeableness (Sanchez-Ruiz *et al.*, 2011; Soldz & Vaillant, 1999) and negative relationships was also determined (Furnham & Bachtiar, 2008).

Studies by Avni, Kipper and Fox (1987) and Kelly (1985) present indirect evidence for the relationship between creative personality traits and chess-playing strength. Avni *et al.* (1987) studied three groups of chess players with a) highly-competitive skills, b) moderately-competitive skills and c) a group of non-players ( $n=20$  each), measured using the Minnesota Multiphasic Personality Inventory. The results demonstrated that chess players achieved higher levels than non-players in terms of orderliness and unconventional thinking. In addition, the highly-competitive players were unlike the non-players as they were significantly more suspicious. In Kelly (1985), a study consisting of 734 people (1500-2200 ELO), the participants were classified into two groups: initial master and average from the point of playing strength. The abridged version of the Myers-Briggs type indicator was used as the data-collecting instrument. Stronger players tended to be more intuitive than weaker players.

### 1.3. Theoretical framework

Gardner (1983) states that cognition function is composed of several factors and each factor functions according to its own set of rules. He notes that exceptional responses were related to specific domains that required different kinds of skills and specific types of knowledge. On the other hand, different suggestions have been made in various studies related to the principles that should be formed according to creativity domains (Feist, 2004) or the number of existing domains (e.g. Carson, Peterson & Higgins, 2005; Oral, Kaufman, & Agars, 2007).

Kaufman (2012) has suggested the theoretical grounding of creativity domains, such as scholarly, mechanical/ scientific, performance, self/ everyday and art. Scholarly creativity would reflect Ivcevic and Mayer's (2009) intellectual creativity, Feist's (2004) linguistics and Gardner's (1999) linguistic intelligence. Mechanical/ scientific creativity would cover Gardner's (1999) logical-mathematical and naturalistic intelligences, Ivcevic and Mayer's (2009) intellectual creativity and Carson, Peterson and Higgins's (2005) science factor. Performance would include Gardner's (1999) bodily kinesthetic and musical intelligence, Ivcevic and Mayer's (2009) performative arts and Feist's (2004) music. Self/everyday creativity would cover Gardner's (1999) ideas about interpersonal and intrapersonal intelligence and Ivcevic and Mayer's (2009) creative lifestyle. Theoretical frameworks for art creativity would be grounded in Gardner's (1999) spatial intelligence, Carson *et al.*'s art factor and Feist's (2004) art.

### 1.4. Present study

The results of the studies, in which the relationships between chess and intelligence are inconsistent and scattered in terms of both methodology and the dimensions of cognitive characteristics, have been analysed. Some of the studies are limited. Other than the study in Venezuela, the number of participants varied between 15 and 90 in the studies where relationships between chess-intelligence and chess-creativity were analysed (Ferguson, 1995). The generalisability of the results of that study is low. Thus, studies that include larger samples are required. Moreover, the process of peer-review was ignored in the studies of Frank (1978) and Ferguson (1995). This study main goals answers to the following question:

- Is there a significant difference in creativity domains (scholarly, mechanic/ scientific, performance, self/ everyday and art) in different groups of students (gifted player, gifted non-player, non-gifted player and non-gifted non-player).

## 2. Method

### 2.1. Participants

The study was conducted using data obtained from a total of 476 students at a high school that gifted (highly-intelligent) students attended and another high school that non-gifted students attended during 2014-2015. Gifted students acquire the right to enroll in the high school as long as they have a score of +2 *Sd* or higher from at least one WISC-R IV verbal, performance or index score. Of the students, 260 (54.62%) were gifted. Among these, 52 (10.92%) were female, while 81 (17.02%) were male. Among those who did not know how to play chess, 79 (16.60%) were female, while 48 (10.08%) were male. Of the students, 216 (45.38%) were not gifted. Among those students who knew how to play chess, 40 (8.40%) were female, while 55 (11.55%) were male. Among the students who did not know how to play chess, 74 (15.55%) were female, while 47 (9.87%) were male.

### 2.2. Measures

#### 2.2.1 Kaufman Domains of Creativity Scale (KDOCS-TR)

The scale, developed by Kaufman (2012), was adapted for use in Turkish culture by Şahin (2015b, 2016). As a result of the adaptation, a structure consisting of five factors and 42 items emerged. The fit indices of the model were determined to be good values ( $\chi^2/df= 1.94$ ,  $GFI= .78$ ,  $CFI= .93$ ,  $RMSEA= .06$ , and  $SRMR= .07$ ). The internal consistency reliability coefficients of the KDOCS-TR form were determined as follows: for the scholarly creativity: .87; for the mechanical/scientific: .84; for the performance: .86; for the self/everyday: .77; for the artistic: .83; and for the total: .90. The validation study included *t*-tests among various groups (between the sub and upper segments of 27%) and was found to be significant ( $p<.01$ ). In order to determine the domain-specific creativity levels of the students, the sub-dimensions of the scale were independently used. In this study, the Cronbach alpha internal consistency coefficient of the KDOCS-TR sub-dimensions was between .76 and .86 (Table 1).

#### 2.2.2 Knowledge form

In order to determine the length of time participants had spent playing chess, the researcher prepared a form. While collecting data, those groups (gifted player, gifted non-player, non-gifted player and non-gifted non-player) were classified as "chess players" since 12 students stated they had been playing chess for two to three years, while other students stated a longer period.

Among the students who knew how to play chess, those with a novice level were chosen. Among the chess players with a chess ranking score from the Turkish Chess Federation (UKD), those with a score over 1100 were excluded from the study. Considering the exercise period, which is one of the most important factors that determines performance in chess (e.g., Campitelli & Gobet, 2008; Charness, Tuffiash, Krampe, Reingold & Vasyukova, 2005), those who had played approximately two to three hours a week for the last two years were included in the study. In other words, the study group was formed with students who played between 102 and 156 hours of chess within the last two years.

## 3. Results

### 3.1. Creativity scores of young chess players: Descriptive statistics

Minimum and maximum values, mean, standard deviation and Cronbach's alpha internal consistency coefficients for all variables in this study are presented in Table 1. The values for the creativity domain arithmetic mean score varied between 3.00 and 3.61.

**Table 1**  
Descriptive statistics, and reliability values.

|          |                        | Min. | Max.   | M      | SD    | ̄    | α   |
|----------|------------------------|------|--------|--------|-------|------|-----|
| KDOCS-TR | Scholarly              | 9.00 | 45.00  | 32.51  | 5.68  | 3.61 | .76 |
|          | Mechanical/ scientific | 110  | 55.00  | 36.23  | 8.15  | 3.29 | .86 |
|          | Performance            | 9.00 | 45.00  | 27.73  | 8.66  | 3.08 | .86 |
|          | Self/ everyday         | 7.00 | 35.00  | 21.00  | 6.52  | 3.00 | .84 |
|          | Art                    | 5.00 | 25.00  | 15.68  | 5.29  | 3.14 | .84 |
|          | KDOCS-TR total         | 410  | 204.00 | 133.15 | 23.99 | 3.25 | .92 |

N= 476.

### 3.2. Analysis of group scores

The normalcy of the data set was analysed before the analysis was conducted. The skewness and kurtosis values were not greater than |2.0|. The analysis of the scores of students classified into four groups—gifted player, gifted non-player, non-gifted player and non-gifted non-player—is provided in Table 2. Depending on the giftedness of the participants and chess-playing, both scholarly and performance scores similarly differentiated ( $F=2.699$  and  $9.469$ ,  $p<.05$ ). The results of the LSD post-hoc analysis indicated that there were significant differences among the groups ( $p<.05$ ). The gap scores weighed against non-gifted non-players.

**Table 2**  
Creativity scores of gifted and non-gifted students according to their chess-playing status.

|                       | Groups                             | N   | ̄     | D    | F      | p*** | Significance       |
|-----------------------|------------------------------------|-----|-------|------|--------|------|--------------------|
| Scholarly*            | Non-gifted non-player <sup>1</sup> | 121 | 31.25 | .46  | 2.699  | .04  | 1-2, 1-3, 1-4      |
|                       | Non-gifted player <sup>2</sup>     | 95  | 32.93 | 4.65 |        |      |                    |
|                       | Gifted non-player <sup>3</sup>     | 127 | 32.82 | 5.95 |        |      |                    |
|                       | Gifted player <sup>4</sup>         | 133 | 33.06 | 6.17 |        |      |                    |
| Mechanic/ scientific* | Non-gifted non-player              | 121 | 33.79 | 7.62 | 8.057  | .00  | 1-3, 1-4, 2-4, 3-4 |
|                       | Non-gifted player                  | 95  | 34.99 | .37  |        |      |                    |
|                       | Gifted non-player                  | 127 | 37.56 | .23  |        |      |                    |
|                       | Gifted player                      | 133 | 38.08 | .44  |        |      |                    |
| Performance *         | Non-gifted non-player              | 121 | 24.51 | .28  | 9.469  | .00  | 1-2, 1-3, 1-4      |
|                       | Non-gifted player                  | 95  | 27.66 | .03  |        |      |                    |
|                       | Gifted non-player                  | 127 | 30.04 | .03  |        |      |                    |
|                       | Gifted player                      | 133 | 28.52 | .49  |        |      |                    |
| Self/ everyday**      | Non-gifted non-player              | 121 | 19.09 | .64  | 9.587  | .00  | 1-2, 1-4, 3-4      |
|                       | Non-gifted player                  | 95  | 21.42 | .14  |        |      |                    |
|                       | Gifted non-player                  | 127 | 20.24 | .39  |        |      |                    |
|                       | Gifted player                      | 133 | 23.17 | 7.01 |        |      |                    |
| Art*                  | Non-gifted non-player              | 121 | 13.89 | .80  | 10.721 | .00  | 1-3, 1-4,          |
|                       | Non-gifted player                  | 95  | 14.97 | 5.26 |        |      |                    |
|                       | Gifted non-player                  | 127 | 17.40 | 5.19 |        |      |                    |
|                       | Gifted player                      | 133 | 16.19 | 5.27 |        |      |                    |

\*LSD, \*\*Tamhane's T2, \*\*\* $p<.05$ , 1=Non-gifted non-player, 2=Non-gifted player, 3=Gifted non-player, 4=Gifted player.

Art and mechanical/ scientific scores also significantly differentiated ( $F=10.721$  and  $8.057$ ,  $p<.05$ ). When the results of the LSD were dyadically compared to the scores of gifted non-players and non-gifted non-players, and gifted players and non-gifted non-players, significant differences were found between them ( $p<.05$ ). The gap scores again weighed against non-gifted non-players. Additionally, a significant difference was found for gifted players when the scores of mechanical/ scientific gifted player and non-gifted player, and gifted player and gifted non-player, were compared ( $p<.05$ ). Self/ everyday creativity scores also differentiated significantly ( $F=9.587$ ,  $p<.05$ ). As a result of Tamhane's T2 post-hoc analysis, a significant difference was found against non-players when gifted players and non-gifted non-players, and gifted non-players and non-gifted non-players, were compared ( $p<.05$ ).

#### 4. Discussion and Conclusion

This study aimed to analyse the effects of the status of playing chess on the domain-specific creativity skills of gifted and non-gifted students. The students were classified into four different groups: gifted player; gifted non-player; non-gifted player; and non-gifted non-player). In the study, five different creativity domains (scholarly, mechanical/ scientific, performance, self/ everyday and art) were calculated.

All subscale scores except self/ everyday for gifted players were more significant and higher than for non-gifted non-players. This result indicates that giftedness and/or the status of playing chess are effective on high levels of creativity scores. Another common result was that gifted non-players had more significant and higher scores than non-gifted non-players. This finding highlights that giftedness is solely effective on the differentiation of creativity scores. The descriptive statistics without the self/ everyday creativity score also supported this finding (Table 2). However, there have been inconsistent results in a number of studies that have analysed the relationship between intelligence and creativity. In some studies, the given relationship is supported (Plucker, 2010; Silvia, 2008; Solomon, 1967; Şahin, 2014, 2015a), while others have reported contrary results (Furnham, Zhang, & Chamorro-Premuzic, 2006; Ogurlu, 2014; Richmond, 1966; Sanchez-Ruiz, *et al.*, 2011; Yoon, 2005). Those findings are parallel to the findings of the study employing such relationships.

When the scholarly, performance, self/everyday and KDOCS-TR total scores were considered, the scores of non-gifted players differentiated from their non-player peers. The analysis related to the mechanical/ scientific and self/ everyday creativity scores indicated that the scores of gifted players were higher than their non-player peers. Moreover, the descriptive statistics without the art and performance scores also supported this finding (Table 2). Those findings are consistent with the results reported by Ferguson (1995), which state that chess provided an increase in participants' creative thinking skills.

The analysis of the mechanical/scientific creativity score showed that the scores of gifted players were higher than non-gifted players. This illustrates that gifted students used applied cognitive processes while playing chess more effectively than their non-gifted peers. Those findings are parallel with the studies of Horgan and Morgan (1990), Frank (1978) and Doll and Mayer (1987, as cited in Grabner, 2014).

When the self/everyday creativity scores of gifted non-players and non-gifted non-players were compared, no significant difference was determined between the scores. When theoretically analysed, it can be noted that Gardner's (1999) work on interpersonal and intrapersonal intelligence was an inspiration to Kaufman (2012) as he developed the concept of self/everyday creativity. According to Petrides (2011), the roots of emotional intelligence date back to Gardner's (1999) work on interpersonal and intrapersonal intelligence. The findings of the studies which analysed the relationship between emotional intelligence and general intelligence indirectly support the findings of this study. In studies by Sing and Sharma (2012) and Haro and Castejon (2014), no relationship was observed between the two variants. In studies by Derksen, Kramer and Katzko (2002) and Şahin and *et al.* (2015), a slight positive and significant relationship was determined. In the study of Wolfradtz, Felfe and Koster (2001), a non-significant negative relationship was determined ( $r = -.17$ ).

The results obtained from this study support the research findings of Sing and Sharma (2012) and Haro and Castejon (2014). It was reported in another study that no significant relationship exists between self/everyday creativity and WISC-R IV verbal, performance and index scores (Şahin *et al.*, 2015). This result is parallel to the findings of this study. Self/everday creativity seems independent from general intelligence.

This study has several limits. The first limitation is that the period of the last two years was used for evaluating the periods of chess play among the students. The scores of the students who had been playing chess for longer periods than their peers may differ. In order to avoid such limits, the students with a UKD score over 1100 were not included in the study and the study group was formed with novice chess players. In another study, the creativity levels of novice or expert chess players could be compared. The other limitation, both the creativity measure and the chess playing status are derived from self-report. This is a notable limitation. Because, self-rated method has some problems, such as inattentively filling the responses by its very nature (Silvia, Wigert, Reiter-Palmon & Kaufman, 2012) or high/ low scores obtained from the evaluation instrument parallel to the responses of the teachers (Beghetto, 2006). But, the assessment of creativity through a self-rated method is extremely informative on the occasions

where no information is available on the levels of the participants (Kaufman, Evans, & Baer, 2010; Şahin & Şahin, 2012, 2013). The results of the analysis contributed to chess-playing supports several creative cognitive processes. Thus, chess should be a part of the basic curriculum in order to develop creativity in educational institutions.

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