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A Research on the Structure of Intelligence and Creativity, and Creativity Style

Zekâ ve Yaratıcılık ve Yaratıcılık Stili Üzerine Bir Araştırma

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Abstract

The relationship between intelligence and creativity may be linked to the difficulties in defining and measuring methodology. Threshold theory is one of the theories which is used to explain the relationship between them. The aim of this study is to investigate the structures which the creative thinking ability of the gifted students and their intellectual structure is grouped and the structure which their creative thinking ability are alone. Data was gathered using Wechsler Intelligence Scale for Children-R and Torrance Thinking Creativity Test (TTCT). Confirmatory factor analyses were conducted with data from 278 gifted primary school students which contained the grade range of 1 to 3. The results indicate that the TTCT subscores consist of 2 factors called adaptive and innovative rather than a single factor. Besides, the results of the analyses provide support that creativity and intelligence are independent from each other.

Key Words: intelligence, creativity, adaptive, innovative, gifted

Öz

Zekâ ve yaratıcılık arasındaki ilişki, tanım ve ölçme metodundan kaynaklanan sınırlılıklarla da ilişkilidir. Eşik teorisi iki kavram arasındaki ilişkiyi açıklamaya çalışan teorilerden birisidir. Bu çalışmanın amacı üstün zekâlı öğrencilerin yaratıcı düşünme becerileriyle birlikte zihinsel becerilerinin ve yaratıcı becerilerinin yalnız başına yapısını araştırmaktır. WISC-R ve Torrance Yaratıcı Düşünme Testleri kullanılarak veriler toplanmıştır. 1-3. Sınıf 278 üstün zekâlı öğrenciden elde edilen veriler üzerinde doğrulayıcı faktör analizi yapılmıştır. Sonuçlara göre TYDT alt testleri tek faktör yerine adaptif ve yenilikçilik olmak üzere iki faktör altında toplanmıştır. Araştırma bulguları yaratıcılık ve zekânın birbirinden bağımsız olduğuna dair kanıtlar sunmaktadır.

Anahtar Kelimeler: zekâ, yaratıcılık, adaptif, yenilikçilik, üstün zekâ

Introduction

The nature of the relationship between these two concepts is difficult to pinpoint because of multi-dimensional, complex, and inextricable nature of these two concepts. Broadly speaking, the nature of the relationship between intelligence and creativity was viewed from two different perspectives. One approach regarded creativity as a part of intelligence.

In a theoretically respect, early and mostly unidimensional theories of intelligence (Spearman, 1904) regarded creativity as a component of intelligence. The pioneer researcher, Guilford (1967, as cited in Sternberg, Jarvin, & Grigorenko, 2011) suggested the structure-of-intellect model (SOI). SOI asserted that intelligence can be understood in terms of a cube that

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represents the intersection of three dimensions–operations, contents, and products. He originally described divergent production as consisting of four specific abilities. These abilities include fluency, flexibility, originality, and elaboration. Contemporary researchers prefer the more explicit expression "divergent thinking" to describe what they meant by divergent production (Kaufman, Kaufman, & Lichtenberger, 2011).

Horn and Cattell (1966) did not separate the two concepts of creativity and intelligence and divided intelligence into crystallized intelligence (*gC*) and fluid intelligence (*gF*). It is commented that ideational fluency and associational fluency sometimes were treated as indicators of "creativity". Among the characteristics related to creativity, moreover, the structures of adaptive flexibility, flexibility of closure and writing flexibility are also in *gF* and *gC*. Cattell-Horn's *gC* and *gF* theory has been combined with Caroll's (1993) Three-Stratum Theory, which is called the Cattell-Horn-Carroll (CHC) theory (Kim, Cramond, & Vantassel-Baska, 2010). In CHC, the abilities which are called originality, fluency and flexibility are listed under general intelligence.

Interestingly, Alfred Binet included open-ended tasks in the earliest tests of intelligence, which were the typical characteristic of divergent thinking tasks (Runco, 2007). This perspective has been followed by multi-dimendional theories of intelligence, in which creativity was a form of intelligence (Sternberg, 2005). Thurstone (1938, as cited in Özgüven, 2007) criticized Spearman's intelligent theory and assertioned that the intelligent behavior does not arise from a general factor, but rather emerges from seven independent factors that he called primary abilities. Thurstone's multiple factor model is the first theory which –partly- included the abilities of creativity thinking as an independent factor. One of the seven factors in the theory is the word fluency. Word fluency measured ability of the test-taker to think of as many words as possible that begin with a given letter.

Renzulli was one of the first researchers to emphasize creativity in a testable theory of giftedness. "Three Ring – Concept" is listed among the regulators which play a role in the transformation of the intellectual potential into high performance. In the aforementioned theory, the high performance may emerge under two different personality profiles such as academic (schoolhouse type) or productive-creative gifted people (Renzulli, 2005). In the "Berlin Intelligence Structure Model", creativity was considered as a group of processes that are taking place while solving the cognitive tasks such as memory, processing capacity and processing speed (Stoeger, 2009). In the "Differentiated Model of Giftedness and Talent", the giftedness is regarded as one of the four natural abilities (intellectual, creative, socio-affective and sensorimotor) which are all effective in the emergence of giftedness and talentedness (Gagne, 2005). In the Munih Giftedness Model, it is one of the seven capability fields among the predictor variable (intellectual capability, creative capability, social competence, application intelligence, artistic, music, psycho-motor skills) (Heller, Perleth, & Lim, 2005). Gardner (1995) has argued that intelligence is a multifaceted collection of eight distinct intelligences and that creativity is the highest level of application of these intelligences. Multiple Intelli-

gence Theory provides an important theoretic transformation in broadening what might be regarded intelligent behavior and, in turn, has the opportunity to enlarge the definitions of creative giftedness (Kaufman, Kaufman, Beghetto, Burgess, & Persson, 2009).

The second approach viewed intelligence as a sub-component of creativity. According to this, intelligence is one of the factors that help creativity to emerge. Sternberg and Lubart (1991) put forward the theory of investment that positions intelligence as a vital variable that influences creativity. Both approaches seem to acknowledge that there is a relationship between the two.

Relationship of Creativity and Intelligence

Threshold theory is one of the theories which is used to explain the relationship between creative and intelligence. According to this theory, they are related; but relationship between the two is not linear across different levels of intelligence (Jauk, Benedek, Dunst, & Neubauer, 2013; Runco, 2007). This theory agrees with the assertion that they are separate constructs above a minimum level of IQ 120 (Kim, Cramond, & Vantassel-Baska, 2010).

The threshold theory were supported a group of studies (Cho, Nijenhuis, VanVianen, Kim, & Lee, 2010; Fuchs-Beauchamp, Karnes, & Johnson, 1993; Şahin, 2014). However, some other study results did not support (Runco & Albert, 1986; Runco, Millar, Acar, & Cramond, 2010; Preckel, *et al*., 2006; Sligh, Conners, & Roskos-Ewoldsen, 2005). Also, in a meta-analytic study, using 21 studies with totally 45.880 participants, reported evidence that empirical findings do not support the threshold hypothesis, between measures of cognitive ability (designed to measure *g*) and measures of creativity and divergent thinking (Kim, 2005). Sligh and colleagues (2005) stated inverse this theory effect, underlining a larger correlation of intelligence and creativity in the high ability group.

Without threshold effects, other group studies investigated the relationship creativity and intelligence. The most famous of them is the Wallach and Kogan's study (Silvia, 2008). They found that the creativity tests did not correlate with the intelligence tests (average r = .09). Silvia has reanalysis that data. Results revealed that relationship between creativity and intelligence were found significantly and modestly level. In other study, Plucker (2010) has reanalyzed the Torrance's data from 1958 to 2010. Average IQ score for the participant was 121. Three models were established. Results implied creativity and intelligence may simply not be highly or even moderately correlated.

Also, some studies could not detect a relationship between creativity and intelligence. Richmond (1966) examined the relationships among creative, by TTCT, cognitive, and affective production of students with monozygotic and dizygotic twins. The study results indicated insignificant differences between creativity and intelligence.

In different context hold a study; Batey, Furnham and Safiullina (2010) sought to examine the contribution of *gF* and *gC* in predicting three indices of creativity. Creativity index scores were found to be positively and significantly related to *gF* (*r*= .29), but not significantly *gC* (*r*= .10). In same study, Batey, Chamorro-Premuzic, and Furnham (2009) was investigated the contribution of *gF* and IQ in predicting DT. DT fluency was significantly and positively related to the two measures of intelligence (*gF r*= .34, and IQ *r*= .43).

Especially, psychologists interested in the structure of intelligence have relied on factor analysis. Spearman (1904) is one of the pioneer researchers who use this technique. In Thurstone's multiple factor model, Horn and Catell's *gF* and *gC* theory, Guilford's SOI theory, and Carroll's hierarchical model of intelligence are pioneer intelligence theories developed through using factor analysis technique. Except the basic studies mentioned above, there is a large literature which the factor analysis technique is used in order to understand the structure of the intelligence/ ability. The studies related to factor analysis within the frame of intelligence theories will not be discussed anymore since they aren't listed in the primary objectives of this study.

As stated above, the experimental researches which the question "Are the creativity potential and general intelligence the same or do they consist of different structures?" are analyzed through factor analysis technique are rather limited on the contrary to the rich literature on the field of threshold effect although there is a highly rich litereature on the relationships between creativity and intelligence. Wallbrown, Wallbrown, and Wherry (1975) investigated the construct validity of the Wallach-Kogan (W-K) Creativity Test through a hierarchical factor analysis of inter-correlations among intelligence, creativity, and the other variables. The intelligence domain was assessed by WISC-R test. Results indicated that a high degree of separation was evident between the intelligence and creativity domain. According to W-K's assertion, their creativity may assess the discriminating validity of g.

Creativity Style: Adaptation-innovation

When the studies on the creativity are chronologically analyzed, the question of "To what degree is this person creative?" is investigated in the beginning while the current studies focus on the question "How are you creative?" The objective of the level access to investigate creativity was to estimate the capability or traits of creative ability. The spotlight of this second question is related to the manner, form, or style of the creative behavior (or performance). Style means the inclinations or peculiarities which denote a steady manner or way of showing creativity (Isaksen & Puccio, 1988).

Kirton (2011), explain the adaptors and innovators style:

> *…..The more adaptive prefer their problems to be associated with more structure, and with more of this structure consensually agreed, than those who are more innovative. The more innovative are more tolerant, at least while in the pursuit of a solution, of a looser guiding struc-*

> *ture. However, all brains need such structures or they cannot operate… Many structures are required, e.g., the preferred style with which we solve problems, the content of our memory, and our array of skills. Other vital guidelines that are built up by learning are our attitudes and beliefs… Adaptors and innovators do so differently. ….One way summing up these differences is to say that the more adaptive prefer to solve problems by the use of rules (all cognitive structures) and the more innovative do so despite the rules (pg.4).*

The studies were designed especially to test the style/ level distinction, also support the conceptualization of the KAI continuum as a style dimension. In an early study, Kirton (1978, as cited in Isaksen & Puccio, 1988) investigated the tie between the inventory and the Word Fluency measure of the Primary Mental Abilities Battery, the Utilities and Alternate Uses Tests, the Otis (Higher Form A) intelligence test and an English qualifying examination. The correlations between his style of measuring and the levels of those measurements were found to be weak and nonsignificant. Torrance and Yun Horng (1980) studied the relationship between Kirton's measure and a battery of creative level measures. There were convincing interrelationships between Kirton's measure and a number of these level measures.

It was concluded after the analytic studies with several factors that creativity is one magnitude within divergent thinking tests (Proctor & Burnett, 2004; Runco, Plucker, & Lim, 2002–2001; Ayas & Sak, 2014), which are the most commonly used to estimate the creative potential. Clapham (1998, 2004) investigated factor structure on the TTCT. He inferred that the scores of the TTCT primarily reflected one general factor. However, Azevedo's (2007, as cited in Primi, Nakado, Morais, Almeida, & David, 2013) study results' has revealed two factors, the first consisting of fluency, originality, and resistance to premature closure, and the second of creative strength, title abstraction and elaboration, in the Portugal sample. Recently, a two-factor model of creativity, especially based on KAI, has been found to be a better fit than are one dimensional models (e.g. Kim, 2006; Kim, Cramond, & Bandalos, 2006; Krumm, Lemos, & Filippetti, 2014).

Kim, Cramond, and Bandalos (2006) analyzed the underlying structure of TTCT figural forms as a model of creative functioning. In the study, it was nominated that a model with Innovative factor and Adaptive factor would perfectly fit for the entire sample. According to this model, Innovative involved Fluency and Originality; Adaptive involved Elaboration and Abstractness of Titles; and both factors were in relation to Resistance to Premature Closure. In a similar study by Kim (2006), two-factor structure was tested. TTCT–Figural Form A was used. Results indicate that the innovative factor is loaded by fluency, originality, and resistance to premature closure, whereas the adaptive factor is loaded by elaboration, abstractness of titles, and creative strengths.

A similar study was performed by Krumm, Lemos and Filippetti (2014). They examined the structure of creativity calculated by the TTCT-Figural, Form B, via two general factors; innovative and adaptative in a sample of Spanish-speaking children. In the study, the two factors

were confirmed. Results showed that the innovative factor contained the fluency and originality and the adaptive factor was contained the elaboration, abstractness of titles, and resistance to premature closure abilities. However, Isaksen and Puccio (1988) suggested that the distinction between creative style and creative level as measured by the TTCT might not be as clear as asserted by Kirton. They found that innovators were statistically and significantly more fluent and more original.

Anecdotally, the educated participants of the TTCT have noticed that there are two types of people. One type was people who produced instant and peculiar feedbacks and had better scores on fluency and originality; the other type was people who were thinking in detailed and profoundly and did better on elaboration and abstractness of titles (Kim, Cramond, & Bandalos, 2006; Kim, 2006).

The studies which were summarized above and which the creativity styles of the individuals were analyzed are the researches sustained with the general population. According to Shiyko, Rim and Grimm (2012); the researcher specifies some model with the assumption that different subgroups in the sample will have different parameter values such as heterogeneity. Heterogeneity is often present in empirical studies, researchers should always consider potential sources of heterogeneity. In many instances, the researcher may not even be aware of the fact that heterogeneity is causing estimation problems. In this case, researchers need to apply approaches that identify and treat unobserved heterogeneity in the samples (Hair, Hult, Ringle, & Sarstedt, 2014). Therefore, it is recommended that all new models should be examined and validated in a broad sample prior to any subgroup comparisons (Bryne, 2010). In one of their research on creativity; Kaufman, Cole, and Baer (2009), also stated that the subgroups consisting gifted students might mask the general results. Moreover, the studies which analyze the topic of threshold effect present contradictory results.

When the studies mentioned above are reviewed in this sense, no research was obtained related to revealing the fact that whether the creative thinking capabilities of the gifted individuals in the literature are listed under a single factor or more than one factors. When the structures which the intelligence and creative thinking capabilities are grouped are analyzed, a single research was obtained. In the aforementioned research, the average intelligence was sustained with individuals. From this point of view, it was decided to conduct this study. The general purpose of the research is to determine structures which the creative thinking capabilities of the gifted students and their intellectual structure is grouped and the structures which their creative thinking capabilities are solely grouped. Within the frame of this general purpose, the answers will be sought for the following questions:

1. Under which structures do the TTCT subscores of the gifted students appear?
2. Under which structures do the TTCT subscores of the gifted students and the WISC-R subscales scores appear?

Method

Study Group

For this study, Istanbul Avcılar District Directorate of Education maintained a project, funded by the Istanbul Development Agency, partial data in order to identification students was used. Data were collected with convenience sampling method and obtained through the Avcılar Province. 278 primary school students which included grade range of 1 to 3 (age range from 6:00 to 9:60; 76 of students 6:00 to 7:00, 71 of students 7:00 to 8:00, 103 of students 8:00 to 9:00, 28 of students of 9:00-9:60) were applied intelligence and creativity test. The intelligence score of the students was determined as +1≥ standard deviation (IQ score of 115 and above). 89 of the students who are identified as gifted were in the first grade (Female= 33, Male= 56), 83 of them were in second grade (Female= 30, Male= 53), and 106 of them were in the third grade (Female= 38, Male= 68).

Data Collection Tools

Wechsler Intelligence Scale for Children-Revised (WISC-R). WISC-R was developed, based on the concept of one-dimensional intelligence is a measurement tool. It is used to determine level of students' intelligence. It was developed by Wechsler in 1949 and was revised in 1974. IQ and factor Index scores yield standard scores with a mean of 100 and a standard deviation of 15 (Özgüven, 2007). The test was adapted to Turkish by Savaşır and Şahin (1994, as cited in Tan, Soysal, Aldemir, & Işık, 2012) for 6-16 age group. Two half-test reliability was calculated as .97 for total intelligence section. Correlation between sub-tests was between .51 and .86. In this study, Guttman split-half coefficient is .93 total scale.

The threshold cut-off point may be assessed differently in the studies which giftedness is described according to the psychometric approach. In this study, the students having the standard deviation values of +1≥ were regarded as gifted ones inspiring the classifying system of Silverman (1998).

Torrance Thinking Creativity Test (TTCT). One of those is the most widely used TTCT among to developed for measuring the divergent thinking (Kim, Cramond, & Bandalos, 2006; Runco & Acar, 2012). The TTCT is based on Guilford's SOI concept. The TTCT-Figural consists of three activities: Picture construction, picture completion, and repeated figures of lines or circles. Students' performance in creative thinking was measured using the TTCT, figural forms (Kim, Cramond, & Bandalos, 2006). The post-1984 version of the test consists of five norm-referenced subscales: Fluency, originality, elaboration, abstractness of the titles and resistance to premature closure. They are derived from the same response data.

In this study, 2007 version of the test was used but the norm study had not been administered for Turkey for this version. However, it was noted that the studies were conducted in different cultures with TTCT figural forms and no difference was observed in the creativity

potential according to the variables such as gender, race, socio-cultural and educational factors (Cramond, 1993, as cited in Kim, Cramond, & Bandalos, 2006). Considering this result, the grade norms of United States of America, where the test was first developed, has been used in this study. Grade level (from 1 to 3) KR-21 reliability scores are computed as .87, .86 and .87, respectively (Torrance, 2008). In this study, Guttman split-half coefficient is .72 total scale.

Data Analysis

Confirmatory Factor Analysis (CFA) were conducted to test the fit of several factor models including one, two and, three-factor models using the LISREL program (Jöreskog & Sörbom, 1993), because of the technique of CFA analyzes a priori measurement models in which both the number of factors and their correspondence with the indicators are explicitly specified (Kline, 2011).

According to Myers, Ahn and Jing (2011), 300 or more subjects were considered enough in society-based studies in order to execute CFA. The number of the participants (n= 278) in this study was considered enough to execute analysis. The values of univariate skewness and kurtosis were examined to see whether each variable was approximately normally distributed. In the analyses, Robust Maximum Likelihood was applied, because of values of the skewness and kurtosis were greater than |2.0|.

In order to interpret the fit of each model, I followed the suggested indexes of Kline (2011). This included reporting goodness of fit index (GFI), comparative fit index (CFI), root mean square error of approximation (RMSEA) or standardized root mean square residual (SRMR). The consistency (Parsimonious) is regarded as a criteria for choosing among the alternative models. The Parsimony Goodness-of-Fit Index (PGFI), the Akaike Information Criterion (AIC), the Consistent AIC (CAIC) and Expected Cross-Validation Index (ECVI) are the measures related to the consistency of the models used in the assessment of consistency (Hooper, Coughlan, & Mullen, 2008). Although both PGFI and PNFI take values between zero and one, higher values show better consistency. To be known as "information criteria"; the AIC, CAIC, and ECVI indices are the indicators which are used in the comparison of more than one models, the low levels of those three indicators mean better consistency, on the contrary to -PGFI and PNFI (Jöreskog & Sörbom, 1993).

Results

The values of the mean and standard deviation of the TTCT and WISC-R subscales are reported in Table 1.

Table 1. Descriptive Statistics

Scale	Subscale	*M*	*SD*
WISC-R	Information	13.01	4.01
	Similarities	15.86	3.00
	Arithmetic	15.63	3.30
	Vocabulary	8.72	2.43
	Comprehension	11.31	3.21
	Picture completion	11.09	3.27
	Picture arrangement	11.70	3.30
	Block design	12.42	3.35
	Object assembly	13.79	3.31
	Coding	4.77	1.26
	WISC-R Total	129.76	9.93
TTCT	Fluency	92.32	18.25
	Originality	93.56	20.62
	Elaboration	99.23	29.43
	Abstractness of titles	88.68	30.71
	Resistance to premature closure	94.55	22.94

The values of the mean and standard deviation of the TTCT and WISC-R subscales are reported in Table 1. WISC-R consists of 10 sub-scores which its mean varied between 15.86±3.00 and 4.77±1.26. Total score is 129.76±9.93. TTCT consists of 7 items that vary between 99.23±29.43 and 88.68±30.71.

Under which Structures do the TTCT Subscores of the Gifted Students Appear?

Within the scope of the first question of the research, two different models were established. In the first of the models, the single factor structure of TTCT subscores was analyzed. In the other model, the two-factor model which was developed being inspired from KAI creativity style was established. Fit indexes for the one- and, two- factor models are shown in Table 2. In the analysis, standardized CFA values were analyzed.

Table 2. Results of Model Comparison with One, Two, and Three Factors

Models	χ^2	df	χ^2/df	GFI	CFI	RMSEA	SRMR
Model 1	10.25*	5	2.05	.99	.99	.06	.02
Model 2	5.11*	4	1.28	.99	1.00	.03	.02
Model 3	473.97**	64	7.41	.79	.93	.15	.09
Model 4	503.12**	87	5.78	.81	.93	.13	.14
Criteria			2.50≤ good (Kline, 2011), ≤5.00 poor coherence (Hooper, Coughlan, & Mullen, 2008)	.90≥ good, .90< poor coherence (Hooper, Coughlan, & Mullen, 2008; Hu & Bentler, 1999)		.05≤ perfect, .06≤ good (Hu & Bentler, 1999) ≤10.00 poor coherence (Kline, 2011)	.08≤ good (Hu & Bentler, 1999)

*$p > .05$, ** $p < .01$.

The χ^2/df values of the Model 1 and Model 2 were found as 2.05 and 1.28. It is indicated that both models are a good fit index. GFI and CFI values posited also a good coherence. Both of the SRMR values were seen to be a good fit index, too. The RMSEA values of the Model 1was found as .06, this indicates a perfect coherence, but Model 2 estimated good coherence. As can seen Figure 2; Model 2 results posited that innovative factor is loaded by fluency, originality, and, elaboration, however the adaptive factor is loaded by abstractness of titles, and resistance to premature closure. But, the results of Model 1 include all subscores. According to values of goodness of fit index, the Model 2 fit to seen better than Model 1. Both of two models were further analyzed by examining values of parsimonious fit index.

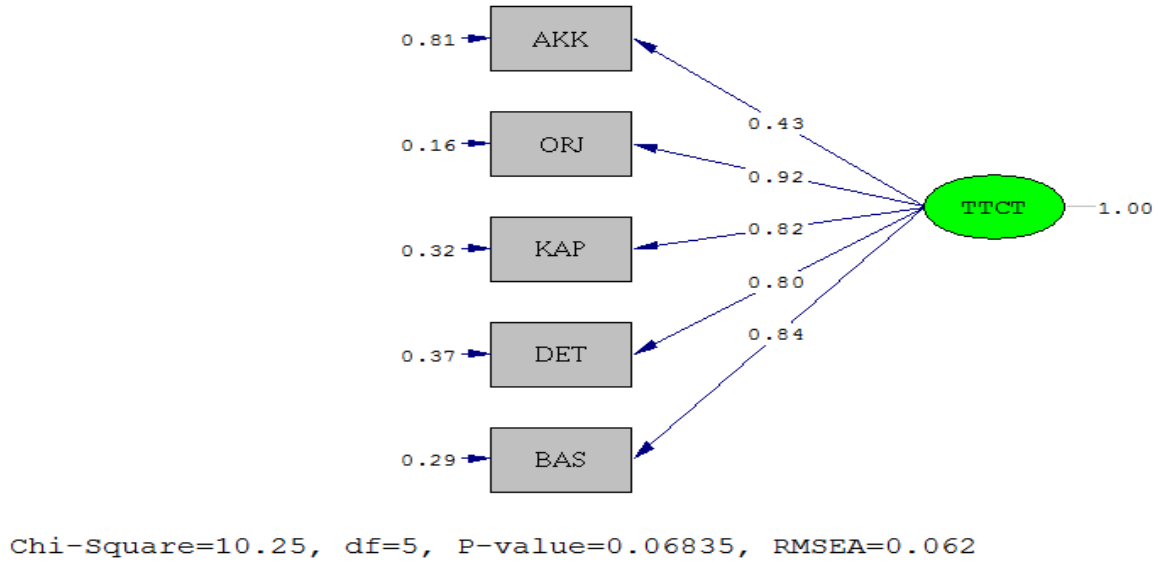

Figure 1. *Model 1. Titles, AKK= Fluency, ORJ= Originality, KAP= Resistance to premature closure, DET= Elaboration, BAS= Abstractness of titles.*

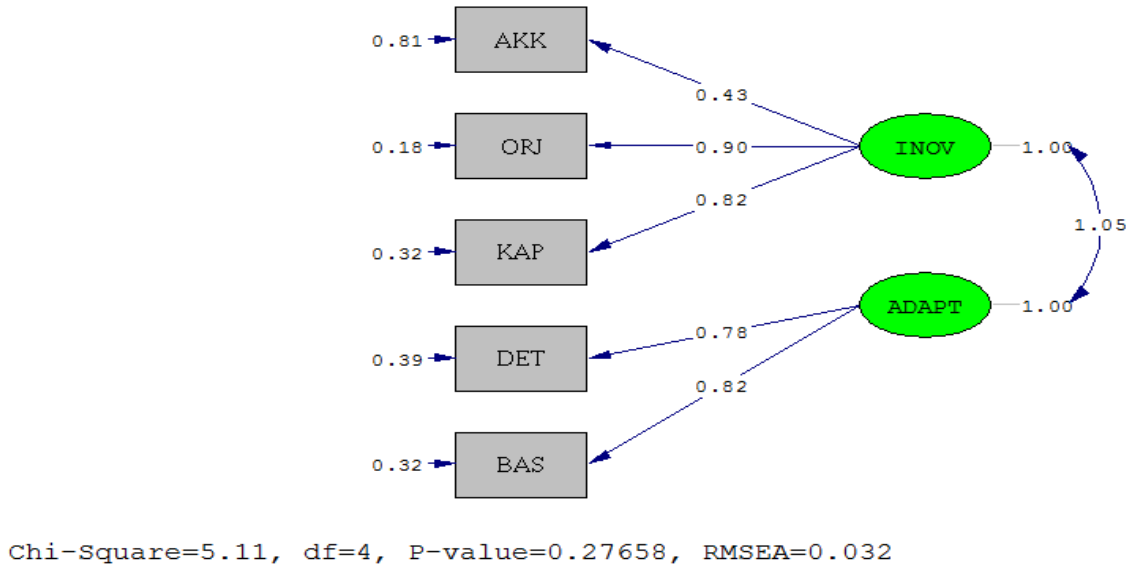

Figure 2. *Model 2. Titles, AKK= Fluency, ORJ= Originality, KAP= Resistance to premature closure, DET= Elaboration, BAS= Abstractness of titles, ADAPT= Adaptive, INOV= Innovative.*

Table 3. Values of Parsimonious Fit Index.

Models	PGFI	PNFI	AIC	CAIC	ECVI
Model 1	.33	.49	30.25	76.53	.11
Model 2	.26	.40	27.11	78.01	.11
Model 3	.56	.75	527.97	652.92	.66
Model 4	.59	.76	569.12	721.83	.87

PGFI, PNFI, ACI, CAIC and ECVI values of the Model 1 and Model 2 are .33 and .26; .49 and .40; 30.25 and 27.11; 76.53 and 78.01; .11 and .11, respectively. According to values of PGFI, PNFI, and CAIC it is indicated that Model 1 fit to seen better than Model 2. However, AIC showed contrary of that. ECVI value indicated that both of two model is seen the same. Model 1 and 2 were also investigated by examining parameter estimates. In the other hand, low R^2 values suggested contrary (Kline, 2011). While fluency R^2 value was found as .19, the other subscores values were .60 and above.

Under which Structures do the TTCT Subscores and WISC-R Subscale Scores of the Gifted Students Appear?

In order to determine the structures which intelligence and the capacities of creative thinking appear, two different models were established within the frame of the first question of the research. The whole WISC-R IV subscale scores and TTCT subscores were analyzed within the structure of single factor. However, the established factor didn't function. Then, the two-factor structure was tested. In the two-factor structure, the *t* values of elaboration and resistance to premature closure wasn't found significant in the model. The aforementioned subdimensions were respectively excluded from the model and the analyses were repeated. In conclusion, the two-factor structure which was projected in Figure 3 was obtained.

Fit indexes for the two- and, three- factor models are shown in Table 2. As can seen Figure 3, Model 3 results pointed that the WISC-R factor, called WTOP, is loaded by information, similarities, arithmetic, vocabulary, comprehension, picture completion, digit symbol, picture arrangement, block design, object assembly, and symbol search, whereas the TTCT subscores is loaded fluency, originality, and abstractness of titles. However, a three-factor emerged in Model 4 (Figure 4).

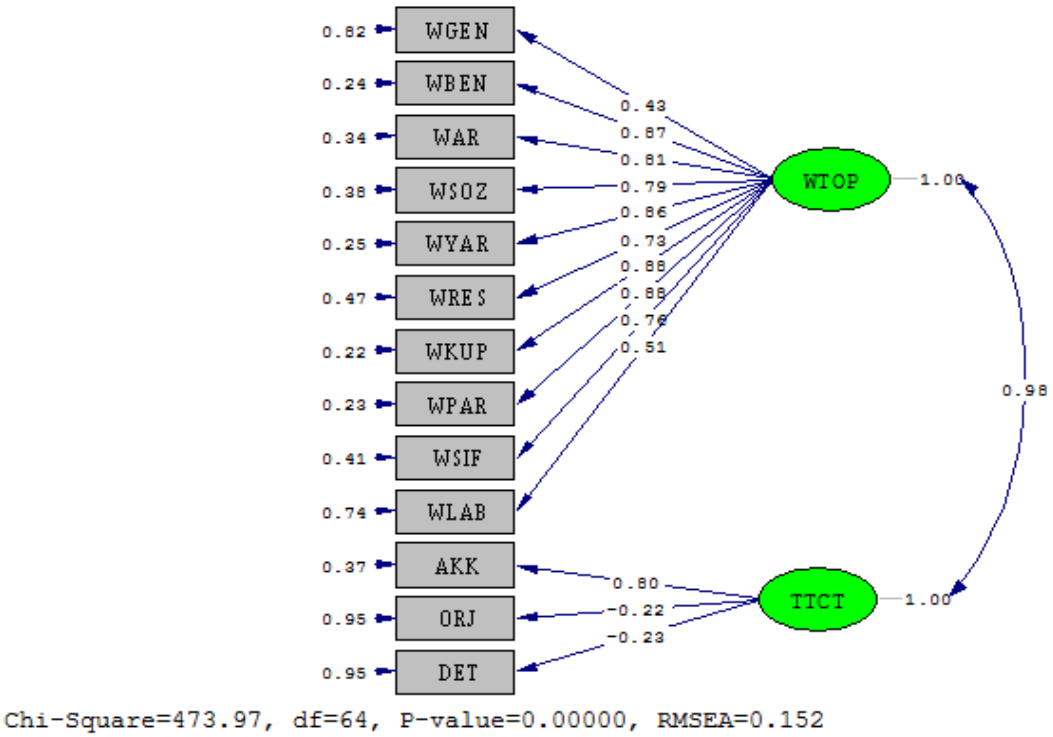

Figure 3. *Model 3. Titles, WGEN=* Information*, WBEN=* Similarities*, WAR=* Arithmetic*, WSOZ=* Vocabulary*, WYAR=* Comprehension*, WRES=Picture completion, WKUP=Block design, WPAR=Picture arrangement, WSIF= Coding, WLAB=Object assembly, AKK= Fluency, ORJ= Originality, DET= Elaboration.*

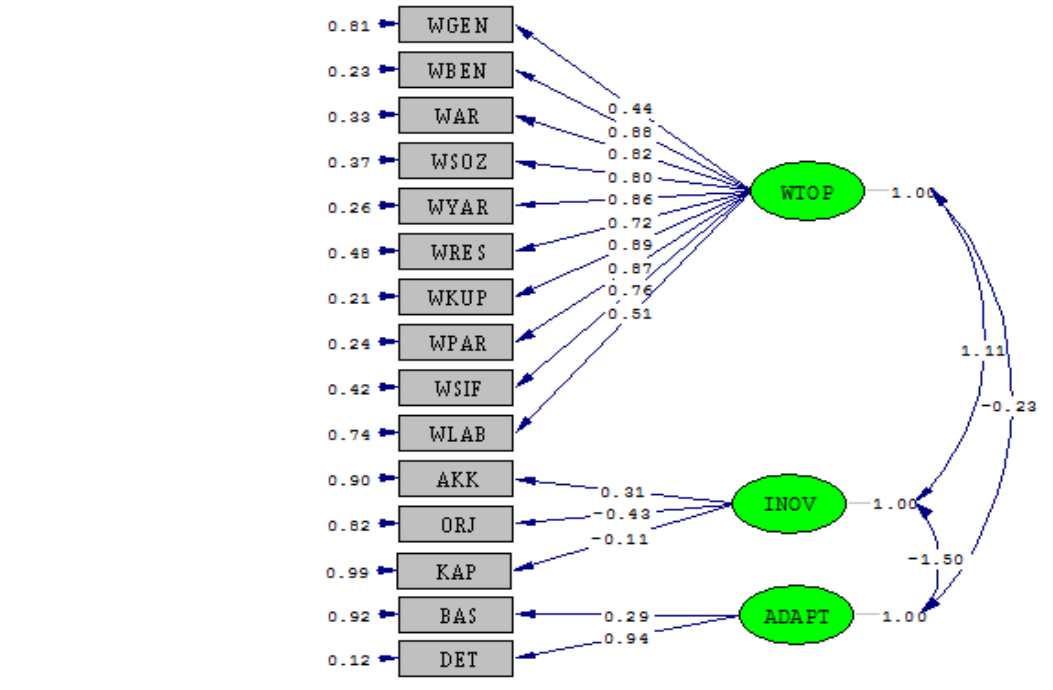

Figure 4. *Model 4. Titles, WGEN= Information, WBEN= Similarities, WAR= Arithmetic, WSOZ= Vocabulary, WYAR= Comprehension, WRES=Picture completion, WKUP=Block design, WPAR=Picture arrangement, WSIF= Coding, WLAB=Object assembly, AKK= Fluency, ORJ= Originality, KAP= Resistance to premature closure, DET= Elaboration, BAS= Abstractness of titles. ADAPT= Adaptive, INOV= Inovative.*

Discussion

The overall objective of this study is to examine the structure of intelligence – creativity and creativity at the latent variable. For the first problem statement, I inspired the Wallbrown, Wallbrown, and Wherry' (1975) study and in the second by Kim (2006), Kim and colleagues (2006), Krumm and colleagues (2014) were inspired.

Under which Structures do the TTCT Subscores of the Gifted Students Appear?

It can be seen that the chi-square values and good fit index suggested that the proposed Model 2 in this study was a much better fit than Model 1. Figure 2 illustrated two – factor model. Results indicate that the innovative factor is loaded by fluency, originality, and elaboration, whereas the adaptive factor is loaded by and abstractness of titles, and resistance to premature closure. Parsimonious index supported it. Also, the large values of the factor loadings and large indicated that the subscales were a good measure of their factors (Kline, 2011). He points out that fluency subscale is not as highly related to the innovative factor as the other subscales loaded on that factor while other sub-factors could measure the R^2 value factors well.

The emerge of TTCT sub-scores within a two-factor structure is parallel with Krumm, Lemos, and Filippetti (2014), Kim (2006), Kim, Cramond, and Bandalos (2006), and Azevedo (2007, as cited in Primi, *et al.,* 2013) studies results'. However, they were a bit more different than this study results. In the studies of Kim (2006) and Kim, Cramond, and Bandalos (2006), it appeared that resistance to premature closure was related to both adaptive and innovative factors. In the study of Krumm, Lemos, and Filippetti (2014), fluency and originality was loaded by innovative, whereas the other subscores was loaded by adaptive. Additionally, Azevedo (2007, as cited in Primi, *et al.,* 2013) found that a two-factor structure emerged from the TTCT subscores that occurs at the end of the study. The aforementioned studies are parallel with the emerging of TTCT scores within a two-factor structures. Another similarity is that the fluency and originality appeared within a continuous factor while the abstractness of titles emerged within another continuous factor. It was seen that the other factors may emerge within different factors in different studies.

Five different studies, including this one, contains participants in Turkey, the USA and Spanish speaking countries, and Portugal from different age ranges, intelligence levels and cultures. The creativity style may differ according to gender (Krumm, Lemos, & Filippetti, 2014) and grade levels (Kim, Cramond, & Bandalos, 2006). The TTCT-Figural scores is purported to be fair in terms of gender, race, socioeconomic status, and cultural backgrounds (Cramond, 1993, as cited in Kim, Cramond, & Bandalos, 2006). The reasons for the consistency and versability in the structures in which TTCT subscores emerge is another topic to be deeply analyzed.

In addition to these findings, the emerging of TTCT sub-scores within a two-factor structure is inconsistent with theoretical literature on the TTCT in that Torrance (2008) suggested five different factors, and TTCT is not unidimensional, as proposed by Clapham (1998, 2004). The results of CFA showed that the two-factor model proposed in this study had a much better fit than the one general factor model. The findings of this study endorsed the observations of the test scorers (Kim, Cramond, & Bandalos, 2006; Kim, 2006), theoretically interpretation of Kirton's (2011) and several studies results' (e.g., Isaksen & Puccio, 1988; Kim, Cramond, & Bandalos, 2006; Kim, 2006; Krumm, Lemos, & Filippetti, 2014; Torrance & Horng, 1980).

Under which Structures do the TTCT Subscores and WISC-R Subscale Scores of the Gifted Students Appear?

In order to determine the structures which TTCT subscores and WISC-R subscale scores of the gifted student exist, all the scores were tested in a single-factor. CFA parameters pointed out that the structure didn't function. There may be a few basic causes. First of them may be the result of focusing of the intelligence tests in order to measure the *g* through TTCT following the SOI model developed by Guilford on different thinking abilities (convergent – divergent thinking).

Wallbrown, Wallbrown, and Wherry (1975) postulated that the creativity domain included a general creativity factor but bifurcated at the primary level to a visual creativity and a verbal creativity factor. In another study which the creativity is analyzed focusing on the field, seven different structures were observed (Kaufman, Cole, & Baer, 2009). Also, a low level of relationship was observed between TTCT verbal and figural tests (Cramond, Matthews-Morgan, Zuo, & Bandalos, 2005). These results may indicate another reason for not supporting a single-factor structure in this study. Because, there is a measurement in WISC-R IV which includes the fields such as general knowledge and language competencies while only figural field is measured in TTCT Figural form.

Upon not supporting the single-factor structure, two different models containing two and three factors were established. The chi-square value and good fit index suggested that Model 4 (in Figure 4) is fitter than Model 3 (in Figure 3). Additionally, model 4 values indicated that elaboration R^2 values were highly related to adaptive factor, whereas similarities, arithmetic, vocabulary, comprehension, picture completion, picture arrangement, block design and object assembly of WISC-R subscales R^2 values were highly related to WTOP factor.

It has been thought that these findings could be indirectly explained through the correlation research findings which the relationship between the creativity and intelligence is analyzed. In different studies, the correlation between the creativity and intelligence was determined between .00 and .43 (Batey, *et al.,* 2009; Batey, *et al.,* 2010; Cho, *et al.,* 2010; Fuchs-Beauchamp, *et al.,* 1993; Hamivand, 2012; Kim, 2005; Plucker, 2010; Preckel, *et al.,* 2006; Richmond, 1966; Runco & Albert, 1986; Runco, *et al.,* 2010; Silvia, 2008; Sligh, *et al.,* 2005; Şahin, 2014; Virgolim, 2005). Even, there are studies which cited negative correlation (Batey & Furnham, 2006). It is

possible that two variables can indicate no correlation if they have a curvilinear relationship (Schucmacker & Lomax, 2010). On the contrary, higher correlations between two factors indicate the overlapping of the structures.

In the study which the intelligence and creativity is factorially analyzed, the findings showing that both structures are independent of each other were obtained (Wallbrown, *et al.*, 2007). Those results are consistent with the findings of this research. When those results are considered together, it can be said that Model 4 supports the results of the studies reporting the intelligence and creative thinking ability are different structures.

In summary, the findings of this study points out that information related to the strong and weak aspects of the creativity potentials of the gifted individuals depending on the TTCT results as well as their creativity styles. Moreover, the point of view in the contemporary intelligence theories which creativity is regarded as an ability independent from intelligence was supported at the end of this study conducted with gifted students.

The researchers who feel interested in the topic may analyze whether the creativity styles of the individuals differ among the individuals who are ranked different intelligence levels. Moreover, this study was conducted in Turkey. Similar studies to be executed in different cultures may provide opportunity to make comparison(s) between the cultures. Another research topic is the instruments which may provide limited measurements in the fields the item pool of tests may enable. In this research, the WISC-R was employed as the intelligence test and the TTCT was used as the creativity test. Being able to conduct the researches which different test batteries are used will provide obtaining more detailed information related to the structures of intelligence and creativity.

Limitations

There is some limitedness in this study. The first of them is that the general intelligence and the creativity potential (divergent thinking) of the individuals were limited. The other limitedness is related to the methodologies used in the studies which the relationship between the creativity and intelligence is analyzed. Both in the correlation analyses and in the studies which factor analysis technique and correlation analysis are employed, the linear relationships between the compared characteristic and the group of characteristics are measured. The synergy (?) or the vice versa (?) between the aforementioned characteristics can't be measured. In other words, it can't be measured whether the structures which may emerge depending on dense interaction between both structures, namely, depending on the occasion of different problems act dependently or under each other.

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