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RELATIONSHIP OF INTELLIGENCE AND ORIGINALITY OF CREATIVE THINKING IN SECONDARY SCHOOL STUDENTS

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Abstract

Creativity plays a key role in many theories of the giftedness, and from this perspective, the relationship between creativity and intelligence is of particular interest for identification and development of high ability children. The study aimed to examine the relationship between the originality of creative thinking and general intelligence in the secondary school students of various grade-levels and gender. A total 364 students of grades 5, 7, and 9 from Moscow schools participated in the study. More than 50% of them scored in the IQ-test higher 125 and were nominated by their teachers as intellectually gifted. All participants were examined with the Tests of Cognitive Abilities and the Verbal Tests of Creative Thinking "Unusual Uses". According to the levels of general intelligence, the five subsamples of the students were formed in each grade as the independent variables. The independent variables were the grades and gender. The dependent variables were the originality scores. The results of correlation and regression analyses, as well a series of analyses of variance showed the influence of the level of intelligence on originality only in the grade 5, and the creativity-intelligence relationship in this case could partly be explained by the threshold theory. The intelligence also proved to be predictor to originality from 5 to 7 grades. Our data obtained did not detect any gender differences on the relationship between intelligence and originality in the secondary school students, in agreement to the current studies..

Keywords: Creativity, Intelligence, Gender, Grade, Secondary School. .

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1. Introduction

The question of the relationship between intelligence and creativity remains of great interest to researchers. Although most school teachers pay less attention to creativity, than intellectual and academic achievements of students, creativity tends to become a key issue in education, especially in gifted education (Kaufman et al., 2012; Lemons, 2011; Makel & Plucker, 2008). The investigation of the relationship between intelligence and creativity could help to clarify the aspects of each construct that are misjudged. In current psychology creativity is defined as the interaction among aptitude, process, and environment by which an individual or group produces a perceptible product that is both novel (original) and useful as valuated within a social context (Kaufman et al., 2012; Kozbelt et al., 2010; Runco, 2014). In other words, originality is vital for creativity, though is not itself sufficient.

Torrance Tests of Creative Thinking (TTCT) remain the most widely used assessment of creative talent (Kim et al., 2010; Runco, 2014). There is mixed evidence and conflicting opinion to the psychometric quality and practical importance of TTCT, although its reliability, concurrent and predictive validity demonstrated by many authors (Kim et al., 2010; Plucker et al., 2015; Runco, 2014). Despite the fact that all creativity assessments have limitations, they are considered an important method for identification of gifted students. There is reason to believe that traditional IQ tests or achievements are not able to evaluate the full personal potential. Divergent thinking or creativity tests can add to the overall picture of each student and promote a more comprehensive understanding of individual possibilities. In the case of the creativity tests, such as unusual (or alternate) uses tests, much studies find differences in the originality, by measuring of uniqueness or rarity of the ideas generated (Abraham, 2016; Runco, 2014).

Majority of researchers in the field agree with the threshold theory, which supposes that creativity and intelligence correlate only if an IQ score is lower 120, and if IQ is above that threshold, the two constructs are largely independent (Kozbelt et al., 2010; Runco, 2014). However, a few studies empirically investigated this theory, and their results were inconclusive. K. H. Kim's meta-analysis of more than 100 studies demonstrate that the relations between creativity and intelligence are positively and negligible at any IQ level (Kim, 2005). According the results, the kinds of IQ test, creativity tests and subscales, as well age explain the differences in correlation coefficients between the IQ and creativity tests scores. The statistically significant differences are observed between the elementary school group and the groups of middle and high school, as well the adult groups, but any significant gender differences in the relationship between creativity and intelligence are not revealed. Whenever the comparison of two constructs conducted, the way of conceptualization and assessment of each construct shows a significant impact on empirical results (Plucker et al., 2015). Researchers and theorists do not believe that intelligence and creativity are completely orthogonal, but the exact nature of the relationship between them remains an open question.

2. Problem Statement

All the creativity assessments have restrictions, nevertheless they are recommended to include as part to any identification system for gifted children, in addition to traditional ability or achievement measures (Kaufman et al., 2012**;** Lemons, 2011). Creativity is both theoretically and empirically related to intelligence, but at a small (but significant) level, therefore it could add valuable information on overall

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abilities of all students, including the double exceptional children (gifted with learning disability). It is believed that these measures can and should work together to create the fullest possible picture of an individual. The amount of hypotheses, theories, and empirical studies on the topic of the relationship between intelligence and creativity has continued to grow (Kaufman et al., 2012; Kim et al., 2010; Plucker et al., 2015), but the age, gender, other individual and typical features of these relations are still unclear.

3. Research Questions

The study addressed the following questions:

- Is there correlation between the originality of creative thinking and intelligence in the secondary school students in a whole sample and in the subsamples of different grades?
- Whether the levels of intelligence influence on the originality of creative thinking in the secondary school students in a whole sample and in the subsamples of different grades and gender?
- Is the level of intelligence a reliable predictor of originality of creative thinking in the secondary school students?

4. Purpose of the Study

The present study aimed to examine the relationship between the originality of creative thinking and intelligence in the secondary school students of various grade-levels and gender.

5. Research Methods

5.1. Participants

A total 364 students (equally of girls and boys) of Moscow schools participated in the study. There were 124 fifth graders (mean age = 11.5 years old), 120 seventh graders (mean age = 13.4 years old), and 120 ninth graders (mean age = 16.6 years old). More than 50% of the students in each grade-level scored in the IQ-test higher 125 and were nominated by their teachers as intellectually gifted.

5.2. Measures

All participants were examined with the following instruments in a group:

- The Russian version of the Munich Tests of Cognitive Abilities for Highly Gifted Students – the KFT-HB 4-12 (Heller, 2010). The tests include three scales, consisting of 50 verbal, 48 quantitative, and 50 nonverbal items. The level of complexity of the items corresponds to each grade. The general intelligence score comes from summation of all three scales.
- The Verbal Tests "Unusual Uses" with the objects "Newspaper" and "Wooden ruler" from The Torrance Tests of Creative Thinking (TTCT). Participants asked to think of as many different uses for each object as possible for 6 minutes. The administration and scoring for fluency, flexibility, and originality of the tests were standardized. We examined the originality variable as the most obvious indicator of creative thinking, because of fluency and flexibility are the general indicators for both convergent and divergent thinking process. All participants were repeatedly tested with the same tests of creativity again in two years in the grades 7, 9, and 11.

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6. Findings

The present study results revealed the positive correlations between the KFT-variables of the general intelligence and originality variables in a whole sample of all grade students: $r = 0.213$ at first year and $r = 0.195$ at the third year, $p < 0.001$ (Pearson). However, the analogical correlations separately in the seventh and ninth grades were not significant. Only in the fifth grade the significant correlations were $r = 0.371$ at the first year and 0.337 at the third year, $p < 0.001$. To investigate relationship between intelligence and creativity more detailed, the research was carried out taking into account the grade-level and gender of the school students.

To assess the intelligence influence on originality of creative thinking, concerning to the grade, five subsamples of equal numbers were divided in each grade, according to the total KFT-scores. The five levels of intelligence represented the independent variables: below (1) and above (2) of the average levels, moderately high level (3), high level (4), and exceptional level (5). Three grade-levels also represented the independent variables. The originality scores represented the dependent variables. Two-ways analyses of variance (ANOVA) demonstrated significant influence both of the level of intelligence ($F = 5.761$, $p < 0.001$) and grade ($F = 5.296$, $p < 0.01$) on the originality, but influence of interaction between these independent variables was not significant – see Table 01. Bonferroni post-hoc tests showed that the originality scores in the fifth graders were significantly lower than those in the seventh and ninth graders.

Table 01. Students' Creativity on the first stage of the study: Means, Standard Deviations

Levels of Intelligence	Grade 5		Grade 7		Grade 9		Grade 5 – 9	
	M	SD	M	SD	M	SD	M	SD
1. Below of the average levels	22.08	12.11	38.83	18.51	34.04	12.99	31.38	16.20
2. Above of the average levels	36.32	19.77	41.08	21.86	40.96	14.53	39.47	18.80
3. Moderately high level	36.45	14.38	44.73	18.78	45.52	14.98	42.42	16.58
4. High level	39.07	20.31	36.81	15.74	41.00	19.66	39.08	18.74
5. Exceptional level	42.35	17.08	45.16	19.47	47.22	15.91	44.92	17.46
All levels	35.23	18.30	41.54	19.04	41.72	16.19	39.45	18.09

M = mean; SD = standard deviation.

To assess the intelligence influence on originality of creative thinking, concerning to gender, 5×2 ANOVA was conducted with the levels of intelligence and gender as the independent variables, as well the originality scores as the dependent ones. According to the results, the influence of gender on the originality scores was found neither in the separate grade, nor in the sample as a whole. The intelligence influence was significant only in the grade 5, as one would expect from the foresaid results.

To assess the prolonged influence of intelligence on originality of creative thinking, 5×3 ANOVA with the same intelligence levels (measured in the grade 5, 7, and 9) was performed with the new originality scores (measured in the grade 7, 9, 11) in two years. In a whole sample the results showed significant influence of the level of intelligence on the originality scores ($F = 6.247$, $p < 0.001$) – see Table 02, but the grade-level influence was not significant in contrast to the results of the same students two years ago.

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However, significant influence of the level of intelligence on the originality scores was found in the grade 7 ($F = 4.533$, $p < 0.01$), but not in the grade 9 and 11.

Table 02. Students' Creativity on the third stage of the study: Means, Standard Deviations

Levels of Intelligence	Grade 7		Grade 9		Grade 11		Grade 7 – 11	
	M	SD	M	SD	M	SD	M	SD
1. Below of the average levels	30.16	14.78	40.35	20.62	33.43	17.92	34.52	18.10
2. Above of the average levels	36.20	16.49	43.12	22.87	41.54	19.95	40.30	19. 90
3. Moderately high level	52.23	24.20	47.15	16.60	45.04	17.02	48.04	19.34
4. High level	45.31	28.73	37.81	16.37	38.16	16.24	40.83	21.98
5. Exceptional level	53.30	27.62	49.08	20.72	44.61	16.15	49.00	21.94
All levels	43.13	24.48	43.78	19.76	40.54	17.78	42.49	20.90

M = mean; SD = standard deviation.

In addition, the comparison of the originality scores in 5th and 7th grades showed its essential increase with age (difference = 7.895, $p < 0.001$, according T-criterion for dependent variables) – see table 03. Whereas no significant changes of originality scores from grades 7 to 9 and 9 to 11 were observed.

Table 03. Comparison of Students' Originality of creative thinking at the first and third stage of the study: Means, Standard Deviation, and ANOVA results by the levels of intelligence

Variables		All levels	The Level of General Intelligence in 5 grade					ANOVA	
			1	2	3	4	5	F	Sig
Originality in 5 grade	M	35.23	22.08	36.32	36.45	39.07	42.35	5.050	0.001
	SD	18.30	12.11	19.77	14.38	20.31	17.08		
Originality in 7 grade	M	43.13	30.16	36.20	52.23	45.31	53.30	4.533	0.002
	SD	24.48	14.78	16.49	24.20	28.73	27.62		

M = mean; SD = standard deviation.

The results of conducted regression analyses gave evidence that originality of creative thinking of the 7th graders could be significantly predicted by their general intelligence KFT-variables in the 5th grade ($R = 0.339$; $R2 = 0.115$; $F = 15.872$ (1, 122); $p < 0.001$), but it was not truth for other grades. The results mean that only the 11.5 % variance of the originality scores in the 7th graders is due to the influence of the independent variables of their general intelligence in the 5th grade.

7. Conclusion

The data obtained from our study on the relationship between originality of creative thinking and intelligence in the secondary school students confirm the findings of many researchers that the relationship between creativity and intelligence is very weak and is not always disclosed (Kim et al., 2010; Plucker et al., 2015; Runco, 2014). The results of the correlation analysis did not show the significant relations in the 7th and 9th grade students, and only in the 5th grade the relationship was essential.

Our results of ANOVA with the level of intelligence and grades as the independent variables and originality scores as the dependent variables gave the evidence that the level of intelligence influences on

creativity only in the 5 grade. The relationship in this case could partly be explained by the threshold theory, because originality in the subsample of the fifth graders with the lowest level of intelligence was significantly lower than those in other subsamples of the fifth graders. This data about differences in the character of the creativity-intelligence relationships in the different stage of school education are in agreement with the conclusion of the meta-analysis of publications on this topic (Kim, 2005). In addition, intelligence proved to be predictor to creativity not only at the same time, but in two years, during the period from 5 to 7 grades.

From the perspective of gender differences, the relationship of creativity to intelligence is of particular interest. Empirical investigations on creative ability among children and adults are inconclusive with reference to the impact of gender differences (Abraham, 2016; Plucker et al., 2015). Approximately half of the research reported no significant differences between males and females, whereas the others were characterized by mixed findings, but more often about superior creative abilities in females. But superiority in creative achievements begins to surface in young adult males and manifests through the lifespan. Nevertheless, the results of meta-analysis of many correlational studies did not reveal significant gender differences in the creativity-intelligence relationship (Kim, 2005). Our data obtained also did not observe any gender differences, concerning to influence of the levels of intelligence on the originality variables in the secondary school students.

Prospects of the study are defined by need of expansion of research sample and methods, and qualitative and quantitative analyses of intelligence and creativity aspects, in relation to age (grade-level) and gender.

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