

Gender Difference in the Linear Relationship among Factors of Drawing-Related Creativity in Second-Grade Primary School Students

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Previous scientific studies in primary school students have indicated differences between girls and boys in many aspects of children's drawings, including factors of creativity. To some extent, these gender differences arise as a consequence of gender specificities in children's artistic development. However, the effect of gender on creativity remains ill defined. In the present study, we examined gender differences in measures of visual art-related creativity, including progress in creative development and the linear relationship among factors of creativity in 18 second-grade primary school students. Visual art-related creativity was tested twice during the school year using a drawing test. Our results provide new evidence for gender-specific characteristics of processes involved in creativity expressed through drawings in early school-age students.

Key words: *art education; creativity; drawing; gender difference; primary school.*

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Introduction

Over decades of scientific endeavour, the concept of creativity has remained undefined. Confusion often appears as the result of an unequivocal definition of creativity^{1,2} due to the following:

- (1) The existence of domain-specific creativity³; e. g., creativity has been divided into three major types: artistic/ bodily, science/ mathematics and writing/ communication;
- (2) numerous theories regarding cognitive development (e.g., Piaget, Vygotsky), and intelligence (e.g., Gardner's theory on plural intelligences).⁴
- (3) varying education systems (e.g., Montessori, Vygotsky, Piaget, Reggio Emilia), and
- (4) the complexity of biological substrates and mechanisms implicated in the regulation of creative development from the perspective of an individual and gender.

In an attempt to define creativity, common basic elements of creativity have been suggested⁵, creativity has been defined as the ability to produce novel, original work, such as products, solutions and presentations that can be useful and adaptive, given task constraints⁶. Others have suggested that, besides originality and appropriateness, creative work should also include imagination, productivity, i.e. the ability to produce multiple ideas and problem solving, i.e. the ability to transfer ideas/ concepts into products/solutions⁷.

Visual art-creativity in children's drawings appears in any form of motif, colour, picture composition, or other drawing element that differs from learned drawing patterns, habits, stereotypes, and common drawing elements such

¹ M. A. RUNCO, Creativity, *Annual Review of Psychology*, 55 (2004) 657-687; <http://doi.org/10.1146/annurev.psych.55.090902.141502> (19.09.2016).

² J. STEERS, Creativity. Delusions, realities, opportunities and challenges, *International Journal of Art & Design Education*, 28 (2009) 2, 126-138; <http://doi.org/10.1111/j.1476-8070.2009.01600.x> (01.08.2017).

³ J. BAER, *Creativity and divergent thinking. A task-specific approach*, Hillsdale, Erlbaum, 1993; J. C. KAUFMAN, J. BAER, Sure, I'm creative – but not in mathematics! Self-reported creativity in diverse domains, *Empirical Studies of the Arts*, 22 (2004) 2, 143-155; <http://doi:10.2190/26HQ-VHE8-GTLN-BJJM> (08.12.2015).

⁴ H. GARDNER, *Multiple intelligences. New horizons*, New York, Basic Books, 2006.

⁵ R. J. STERNBERG, T. I. LUBART, The concept of creativity. Prospects and paradigms, in: R. J. Sternberg (ed.), *Handbook of creativity*, Cambridge, Cambridge University Press, 1999, 3-9.

⁶ *Ibid.*, 3.

⁷ J. F. FELDHUSEN, B. E. GOH, Assessing and accessing creativity. An integrative review of theory, research, and development, *Creativity Research Journal*, 8 (1995) 3, 231-247; C. SHARP, *Developing young children's creativity through the arts. What does research have to offer?*, Paper presented to an invitational seminar, Chadwick Street Recreation Centre, London, 2001.

as a heart, a flower or a crown⁸. One way to evaluate creativity measures in drawings is to quantify the factors of creativity; drawing-related originality, flexibility, fluency and elaboration reflect divergent thinking processes, and drawing-related sensitivity to problems, or the ability to recognize problems and redefinition stem from cognitive thinking processes. In relation to creative endeavour, the factors of visual art-related creativity can be further divided into two groups: first, factors such as redefinition, fluency and elaboration that enable creativity, and factors such as originality, flexibility and sensitivity that promote it⁹. In a subsequent study,¹⁰ also reported that complementary interactions between the factors of each group are necessary during the creative process. In practice, the possibility of heterogeneous interpretations of children's drawings and innate inability of children at the early stages of drawing development to explain their motifs, ideas and feelings referring to a particular drawing¹¹ complicate any quantification of artistic creativity in children's drawings. Nevertheless, quantification of factors of visual art-related creativity has become a convenient and reliable means for assessing visual art-related creativity in children¹².

The rate of creative development in visual arts changes over the course of cognitive development in an irregular manner. Creative development begins in children around the third year of age. The stage exhibiting an increased rate of creative development from 3 to 6 years of age is then followed by a stage of a reduced rate, which lasts from 6 to 9 years of age, and later again by a stage showing an increased rate that ends at the age of 13 years¹³. Such a developmental pattern of visual art-related creativity suggests greater creativity in children than in adults, and this has been confirmed in the case of greater ability to generate original ideas, higher productivity and better problem solving¹⁴. During the stage of the most intense creative development, up to age 6, visual art-related creativity is mainly affected by parental education and professional education in schools¹⁵. Indeed, teachers are key figures in delivering

⁸ M. DUH, T. VRLIČ, *Likovna vzgoja v prvi triadi osnovne šole. Priročnik za učitelje razrednega pouka*, Ljubljana, Rokus, 2003.

⁹ *Ibid.*

¹⁰ J. HERZOG, Dejavniki likovne ustvarjalnosti in likovnopedagoško delo, *Revija za elementarno izobraževanje*, 2 (2009) 2-3, 19-31.

¹¹ Duh, Vrlič, *op. cit.*

¹² B. KARLAVARIS, M. KRAGULJAC, *Test kreativnega mišljenja*, Beograd, Institut za pedagoška istraživanja, 1972; M. DUH, *Vrednotenje kot didaktični problem pri likovni vzgoji*, Maribor, Pedagoška fakulteta, 2004.

¹³ H. GARDNER, Artful Scribbles. The Significance of Children's Drawings, *Journal of Aesthetics and Art Criticism*, 39 (1980) 4, 464-465; B. KARLAVARIS, *Metodika likovnog odgoja 2*, Rijeka, Hofbauer, 1991.

¹⁴ *Ibid.*

¹⁵ J. MATHEWS, *Drawing and painting. Children and visual representation*, London, Paul Chapman Publishing, 2003.

a relevant, creative, enjoyable experience of arts education¹⁶. In this context, both parents and teachers create the kind of safe environment necessary for children to overcome the anxiety that accompanies the artistic practice and creative endeavour, and thus facilitate creativity¹⁷. In addition, art curricula can be creativity-oriented in the sense that teachers provide an environment for the development of spontaneous and unlimited visual art-related creativity¹⁸ and facilitate creativity in visual arts through observation, curiosity, imagination, divergent thinking, evaluation, self-evaluation, development of other types of creativity and experimentation with novel artistic skills and techniques¹⁹. Clearly, in a creative environment, children's self-evaluation is based on their curiosity and exploration²⁰. Despite these positive effects, parents and teachers do not always facilitate creativity. For example, if the teacher provides materials and encourages children to be creative, or when the teacher leads the children in an exercise and discourages any deviation from the predetermined pattern, these two scenarios of art teaching can stifle creativity²¹. Creative potential may also be inhibited by similar patterns found in parental education. Comparison of children with a low level of creativity and those with high levels of creativity, assessed by a Torrance test of creative thinking, has shown that mothers of highly creative children were less emotionally involved with their children and less overprotective than mothers of less creative children²². Although similar studies on visual art-related creativity are missing, it is reasonable to believe that parental over-control stifles creativity in general. However, to what extent the creativity-inhibiting environment of the domestic environment and the educational system during creative development can compromise creativity later in adulthood is debatable, since creative endeavour also depends heavily on motivation and needs.

Gender differences in creativity have been extensively studied for the last 60 years. Unfortunately, numerous studies on gender differences in creativity

¹⁶ C. SHARP, J. LE MÉTAIS, *The arts, creativity and cultural education. An international perspective (International review of curriculum and assessment frameworks)*, London, QCA, 2000.

¹⁷ J. CARABINE, Creativity, art and learning. A psycho-social exploration of uncertainty, *International Journal of Art and Design Education*, 32 (2013) 1, 33-43.

¹⁸ N. GRGURIĆ, M. JAKUBIN, *Vizualno-likovni odgoj i obrazovanje*, Zagreb, Educa, 1996.

¹⁹ M. CSIKSZENTMIHALYI, *Creativity. Flow and the psychology of discovery and invention*, New York, Harper Collins, 1996; T. A. WRIGHT, Affect, psychological well-being and creativity. Results of a field study, *Journal of Business and Management*, 9 (2003) 1, 21-32; B. JEFFREY, Creative teaching and learning. Towards a common discourse and practice, *Cambridge Journal of Education*, 36 (2006) 3, 399-414; D. W. CHAN, L. CHAN, Creativity and Drawing Abilities of Chinese Students in Hong Kong. Is There a Connection? *New Horizons in Education*, 55 (2007) 3, 77-95.

²⁰ R. BERTSCHEIT, *Bilder werden Erlebnisse. Mitreissenden Methoden zur aktiven Bildbetrachtung in Schule und Museum*, Mülheim an der Ruhr, Verlag an der Ruhr, 2001.

²¹ Sharp, Le Métais, *op. cit.*

²² M. MICHEL, S. Z. DUDEK, Mother-child relationships and creativity, *Creativity Research Journal*, 4 (1991) 3, 281-286; <http://doi.org/10.1080/10400419109534400> (19.09.2016).

have provided inconsistent results²³. The reason lies primarily in the complex nature of creativity. In addition, the level of creativity is influenced by numerous factors, such as age and developmental stage²⁴, parental education²⁵, and different cognitive styles²⁶, some of which are almost impossible to control in experiments. Based on the confounding results, some authors have suggested a lack of gender differences in creativity²⁷, which is in line with the previous observations that most gender differences in cognitive abilities that emerge during development are only temporary and disappear in adulthood²⁸. Overall, much additional work would be required before unequivocal conclusions can be reached about the effect of gender-specific factors on creative development and creativity.

1 Research Problem

Given the plethora of theories regarding human cognitive development and cognition that span all branches of science and the role of creativity in all spheres of life, the concept of creativity remains ill defined. If we consider creativity a neurobiological process, then the research into human biology, such as studying gender differences and underlying biological substrates, will substantially increase our understanding of creativity. In a seminal study,²⁹ discovered that free drawings by preschool children aged 5–6 years differed between boys and girls in motifs, colour, figure composition, and expression³⁰. Boys had a tendency to draw mobile objects and mechanical objects with dark, cold colours and used bird's-eye-view composition, whereas girls more often drew human motifs, flowers and butterflies with light, warm colours and arranged motifs in a row. Furthermore, the free drawings of girls with congenital

²³ N. KOGAN, Creativity and gender differences, *Journal of Creative Behavior*, 8 (1974) 1-14; <http://dx.doi.org/10.1002/j.2162-6057.1974.tb01103.x> (05.06.2016); J. BAER, J. C. KAUFMAN, Gender differences in creativity, *The Journal of Creative Behavior*, 42 (2008) 2, 75-105; <http://doi.org/10.1002/j.2162-6057.2008.tb01289.x> (08.08.2017); L. ELLIS et al., *Gender difference. Summarizing more than a century of scientific research*, New York, Psychology Press, Taylor & Francis, 2008; A. ABRAHAM, Gender and creativity. An overview of psychological and neuroscientific literature, *Brain Imaging and Behavior*, 10 (2015) 2, 609-618; <http://doi.org/10.1007/s11682-015-9410-8> (03.07.2017).

²⁴ Karlavaris, *op. cit.*

²⁵ Michel, Dudek, *op. cit.*

²⁶ Abraham, *op. cit.*

²⁷ Baer, Kaufman, *op. cit.*

²⁸ D. F. HALPERN, *Gender differences in cognitive abilities*, New York, Psychology Press, Taylor & Francis, 2012.

²⁹ M. IJIMA et al., Sex differences in children's free drawings. A study on girls with congenital adrenal hyperplasia, *Hormones and Behavior*, 40 (2001) 99-104; <http://doi.org/10.1006/hbeh.2001.1670> (12.02.2016).

³⁰ *Ibid.*

adrenal hyperplasia (CAH) who are exposed to high levels of androgens during development (similar to boys) showed strong masculine characteristics, suggesting that the gender differences seen in free drawings may also have a biological origin³¹. Of note, similar gender differences in the selection of motifs have also been reported among school age students³². Therefore, it is reasonable to expect that creativity may also be a gender specific trait. Numerous studies on creativity so far have not provided definite proof of whether creativity differs between males and females, mostly owing to the conflicting results³³ from and scarcity of creativity research. To our knowledge, there is only one paper on fifth grade students that approached visual art-related creativity from the perspective of gender differences³⁴. On the contrary, developmental studies dealing with visual art-related creativity from the perspective of gender differences in early school-age students do not exist.

2 Research Objectives

The main objective of the pilot study was to explore visual art-related creativity in second-grade primary school students from the perspective of gender differences. We evaluated (1) the level of creativity at two different time points during the school year: at the beginning (initial test) and the end (final test) of the school year; (2) progress in creativity, and (3) linear correlations among scores for factors of creativity.

2.1 Hypotheses

Hypotheses about the gender differences in visual art-related creativity are as follows:

- H1.1: Drawing-related creativity will not differ between boys and girls in the initial drawing test.
- H1.2: Drawing-related originality, flexibility, fluency, redefinition, elaboration and sensitivity will not differ between boys and girls in the initial drawing test.
- H2.1: Drawing-related creativity will not differ between boys and girls in the final drawing test.

³¹ *Ibid.*

³² M. DUH, J. HERZOG, Preference do likovnih motivov pri učencih prvega triletja osnovne šole, *Didactica Slovenica – Pedagoška obzorja*, 27 (2012) 1-2, 17-32.

³³ Baer, Kaufman, *op. cit.*; ELLIS, *op. cit.*, 302; Abraham, *op. cit.*

³⁴ J. HERZOG, M. DUH, Artistic and creative achievements of primary school students with regard to gender and stratum, *Metodočki obzori*, 6 (2011) 1, 37-48.

H2.2: Drawing-related originality, flexibility, fluency, redefinition, elaboration and sensitivity will not differ between boys and girls in the final drawing test.

Hypotheses about gender differences in progress in visual art-related creativity are as follows:

H3.1: Drawing-related creativity will not differ between the initial and the final drawing test, irrespective of gender.

H3.2: Progress in Drawing-related creativity will not differ between boys and girls.

A hypothesis about gender differences in the number of linear correlations among scores of factors of visual art-related creativity goes as follows:

H4: The number of linear correlations among factors of Drawing-related creativity will not differ between boys and girls.

3 Methods

3.1 Research Method and Research Sample

In order to evaluate Drawing-related creativity in second-grade primary school students, we designed a non-experimental research study. Quantitative data were analysed by descriptive and inferential statistics. The pilot study was conducted on a sample of 18 students enrolled in the second grade of primary school in Slovenia. There were 8 boys (44.5 %) and 10 girls (55.5 %). From the perspective of inferential statistics (i.e. statistics for testing hypotheses), our sample of 18 students represents a simple random sample from a population.

3.2 Data Collection

Drawing-related creativity was evaluated twice (an initial and a final test) by a drawing test of creativity (the »Kriteriji razvoja« Development Criteria – drawing test), which was taken 8 months apart during the school year and varied only in motif. Children used water-based markers and had enough time to complete the task. Each drawing was evaluated by three independent reviewers blind to the children's gender and age, and the study design. Evaluation of drawing-related creativity was based on drawing-related originality, flexibility, fluency, redefinition, elaboration and sensitivity. The factors of visual art-related creativity were evaluated according to the evaluation scale as reported

previously³⁵ and modified for second-grade students. Such quantification of artistic creativity has proved to be a convenient means for reliable assessment of drawing-related creativity in children's drawings³⁶. A total score in drawing creativity represented the sum of the sub scores of creativity factors. An overall score for both drawing tests was 50. Progress in visual art-related creativity was evaluated by comparing total initial and final test scores. A difference between the final and initial test score was considered as progress only if it reached statistical significance. The sum of the initial and final test was used to analyse bivariate linear correlations among factors of visual art-related creativity.

3.3 *The Drawing Test*

The Development Criteria drawing test allows for unbiased, sensitive and consistent quantification of visual art-related creativity measures, including drawing-related originality, flexibility, fluency, redefinition, elaboration and sensitivity³⁷. Sensitivity to the artistic problem (max. 8 points) measures sensibility to experiencing artistic problems and recognizing artistic problems pertaining to the motif. In the category of elaboration (max. 8 points), we used the test drawings to establish the conceptual design, the preparation of the creative process, aesthetic organization of the expression, the coherence of the idea and the material and artistic planning in accordance with design principles. In the case of artistic flexibility (max. 9 points), what is measured is the discovery of new artistic solutions and artistically divergent thinking, as well as flexible adaptation to the expressive medium. Artistic fluency (max. 8 points) is monitored through the fluency of artistic ideas and the motor skills needed to realize these ideas. Artistic originality (max. 9 points) in the test drawings is recognized in the individual's sensibility and originality in terms of observation. Artistic redefinition in the test drawings (max. 8 points) can be recognized in the delicate observation of those artistic phenomena (elements, details) that are favourable for artistic transposition and for an effective process of artistic transposition. Overall, 50 points could be achieved on the artistic drawing test. Measures of drawing-related creativity are quantified according to an evaluation scale that can be modified for children at different stages of cognitive or artistic development. At the beginning of the test, testing subjects are asked to draw themselves in a room with a creature that is unfamiliar to the testing subjects. Drawings can be made in any drawing medium.

³⁵ B. KARLAVARIS, M. KRAGULJAC, *Razvijanje kreativnost putem likovnog vaspitanja u osnovni školi*, Beograd, Prosveta, 1981.

³⁶ *Ibid*; Duh, *op. cit.*

³⁷ Karlavaris, Kraguljac, *Test kreativnega mišljenja...*; Duh, *op. cit.*

3.4 Statistical Analysis

Statistical analysis was performed using the statistical product SPSS 14.0 (SPSS Inc. Chicago, IL, USA). Descriptive statistics was used to determine general features (minimum, maximum, mean value, standard deviation, skewness and kurtosis) of data sets. Gender differences in visual art-related creativity were analysed by one-way analysis of variance (ANOVA) or a nonparametric Mann-Whitney U test. Normal distribution and homogeneity of variance were determined by a Shapiro-Wilk test and a Leven test, respectively. Differences between the final and initial drawing test scores for boys and girls were determined by a t-test for dependent samples. Linear correlations among factors of visual art-related creativity were determined by a bivariate Pearson's linear correlation analysis. The significance threshold was set at 0.05.

4 Results

4.1 Drawing-Related Creativity at the Beginning of the School Year (Initial Drawing Test)

Drawing-related creativity was evaluated in 18 students, 8 boys and 10 girls. Six factors of visual art-related creativity and a total sum score in drawing-related creativity were evaluated for each drawing. Among factors of visual art-related creativity, we evaluated drawing-related originality, redefinition, elaboration, sensitivity, flexibility and fluency. Overall, none of the students scored the maximum number (50) of points on the drawing test. Descriptive analysis of total sum scores in drawing-related creativity according to gender showed a unimodal symmetric distribution for both data sets. In terms of kurtosis, the degree of flatness differed between the data sets, with the sample of boys showing a flatter distribution than that of girls (Table 1). Both data sets were considered to meet the characteristics of normal univariate distribution in terms of skewness and kurtosis³⁸, which was additionally confirmed with a Shapiro-Wilk test.

³⁸ D. GEORGE, M. MALLERY, *SPSS for windows step by step. A simple guide and reference*, 17.0 Update, Boston, Pearson, 2010.

Table 1: Descriptive statistical analysis of initial drawing test scores.

Skill	Gender	Number (n)	Rang		Mean (\bar{X})	Std Dev (s)	Skewness (Skew)	Kurtosis (Kurt)
			MIN	MAX				
Creativity	Male	8	10	35	24	5	-0.410	-1.067
	Female	10	25	33	25	5	-0.547	1.287

Overall, boys and girls did not differ in the total sum score in visual a drawing creativity, as shown by a nonparametric Mann-Whitney U test (Table 2). A detailed analysis of visual art-related creativity broken down to individual factors of creativity also yielded no gender differences. Both boys and girls scored similarly on drawing-related elaboration, flexibility, originality and redefinition, as shown by one-way ANOVA (Table 3). Similarly, a non-parametric Mann-Whitney U test did not show gender differences in drawing-related fluency and sensibility (Table 4).

Table 2: Total initial drawing test score in visual art-related creativity between boys and girls.

Skill	Gender	Number (n)	Mean (\bar{X})	Mean rang (\bar{R})	Mann-Whitney U	
					U	P
Creativity	Male	8	24	10.21	27.5	0.425
	Female	10	25	8.08		

Table 3: One-way ANOVA for gender differences in drawing-related elaboration, flexibility, originality and redefinition (initial drawing test).

Factor	Gender	Number (n)	Mean (\bar{x})	Std. Dev (s)	ANOVA	
					F	P
Elaboration	Male	8	4	2	0.03	0.874
	Female	10	4	1		
Flexibility	Male	8	4	1	0.09	0.766
	Female	10	5	1		
Originality	Male	8	4	2	0.02	0.897
	Female	10	4	1		
Redefinition	Male	8	3	1	0.02	0.886
	Female	10	4	1		

Table 4: Mann-Whitney U test for gender differences in drawing-related fluency and sensibility (initial drawing test).

Factor	Gender	Number (n)	Mean (\bar{x})	Mean Rang (\bar{R})	Mann-Whitney U	
					U	P
Fluency	Male	8	4	9.25	38.0	0.853
	Female	10	4	9.70		
Sensibility	Male	8	4	7.75	26.0	0.190
	Female	10	4	10.90		

4.2 Drawing-Related Creativity at the End of the School Year (Final Drawing Test)

Drawing-related creativity was evaluated in 18 students. As with the initial test, six factors of visual art-related creativity and a total sum score in visual art-related creativity were evaluated for each drawing. Overall, none of the students scored the maximum number (50) of points on the drawing test. Descriptive statistical analysis of total sum scores in drawing-related creativity according to gender showed a unimodal symmetric distribution and a similar degree of flatness for both data sets (Table 5). In terms of skewness and kurtosis, both data sets showed normal univariate distribution³⁹, which was additionally confirmed by a Shapiro-Wilk test.

Table 5: Descriptive statistical analysis of final drawing test scores.

Skill	Gender	Number (n)	Rang		Mean (\bar{x})	Std Dev (s)	Skewness (Skew)	Kurtosis (Kurt)
			MIN	MAX				
Creativity	Male	8	13	36	23	9	0.428	-1.488
	Female	10	16	36	26	7	0.218	-0.994

Overall, girls scored higher than boys in visual art-related creativity; however, the difference did not reach statistical significance, as shown by one-way ANOVA (Table 6). Similarly, boys and girls scored comparably on drawing-related elaboration, flexibility, fluency, originality, redefinition and sensibility, as shown by one-way ANOVA (Table 7).

³⁹ *Ibid.*

Table 6: Total final drawing test score in visual art-related creativity between boys and girls.

Skill	Gender	Number (n)	Mean (\bar{x})	Std. Dev (s)	ANOVA	
					F	P
Creativity	Male	8	23	9	0.07	0.800
	Female	10	26	7		

Table 7: One-way ANOVA for gender differences in factors of drawing-related creativity (final drawing test).

Factor	Gender	Number (n)	Mean (\bar{x})	Std. Dev (s)	ANOVA	
					F	P
Elaboration	Male	8	4	2	0.39	0.542
	Female	10	5	2		
Flexibility	Male	8	4	2	0.14	0.907
	Female	10	4	1		
Fluency	Male	8	4	1	0.19	0.668
	Female	10	4	1		
Originality	Male	8	4	2	0.02	0.906
	Female	10	4	1		
Redefinition	Male	8	4	2	0.10	0.760
	Female	10	5	2		
Sensibility	Male	8	4	1	0.20	0.428
	Female	10	5	1		

4.3 Progress in Creative Development

Based on two independent tests taken eight months apart during the school year, we evaluated the progress among second-grade student in drawing-related creativity. Overall, the mean score in drawing-related creativity increased by one point (initial (\bar{x})= 24; final (\bar{x})= 25) between the initial and the final test. However, the increase did not reach statistical significance (Table 8).

Table 8: Comparison of initial and final drawing test scores in second-grade students.

Skill	Test	Number (n)	Mean (\bar{x})	Std. Dev (s)	Z-test	
					Z	P
Creativity	Initial	18	24	7	-0.06	0.953
	Final		25	7		

Next, we analysed the progress for boys and girls separately. The mean score in visual art-related creativity decreased by one point in boys and increased by one point in girls over an eight-month developmental time period. For both

genders, the change in drawing-related creativity between the initial and the final test did not reach statistical significance (Table 9).

Table 9: Progress in visual art-related creativity in boys and girls during the second grade of primary school.

Skill	Test	Gender	Number (n)	Mean (\bar{x})	Std. Dev (s)	t-test	
						t	P
Creativity	Initial	Male	8	24	9	2.36	0.853
	Final		10	23	9		
	Initial	Female	8	25	5	2.26	0.744
	Final		10	26	6		

4.4 Linear Correlations among Factors of Visual Art-Related Creativity

To further study gender differences in visual art-related creativity, we analysed bivariate linear correlations among factors of creativity. The number of linear correlations differed between boys and girls, as shown by a bivariate Pearson's linear correlation analysis (Fig. 1). Significant positive linear correlations were found among all the factors (sensitivity, elaboration, flexibility, fluency, originality and redefinition) of visual art-related creativity in boys (Table 10). Unlike in boys, the number of linear correlations was lower in girls, where a test score in drawing-related sensitivity was not in linear relationship with test scores in drawing-related fluency, originality and redefinition (Table 11). Significant negative linear correlations among the factors of visual art-related creativity were not found in this study.

Table 10: Bivariate analysis of linear correlations among factors of visual art-related creativity in boys.

		Sensitiv- ity	Elabora- tion	Flexibil- ity	Fluency	Original- ity	Redefini- tion
Sensitivity	Pearson (r) P-value	1	0.977 0.000	0.977 0.000	0.919 0.001	0.943 0.000	0.859 0.006
Elaboration			1	0.976 0.000	0.966 0.000	0.937 0.001	0.866 0.005
Flexibility				1	0.933 0.001	0.968 0.000	0.858 0.006
Fluency					1	0.924 0.001	0.927 0.001
Originality						1	0.930 0.001
Redefinition							1

Table 11: Bivariate analysis of linear correlations among factors of visual art-related creativity in girls.

		Sensitiv- ity	Elabora- tion	Flexibil- ity	Fluency	Original- ity	Redefini- tion
Sensitivity	Pearson (r) P-value	1	0.652 0.041	0.813 0.004	0.444 0.198	0.510 0.132	0.550 0.100
Elaboration			1	0.848 0.002	0.826 0.003	0.935 0.000	0.904 0.000
Flexibility				1	0.771 0.009	0.783 0,007	0.789 0.007
Fluency					1	0.774 0.009	0.904 0.000
Originality						1	0.754 0.012
Redefinition							1

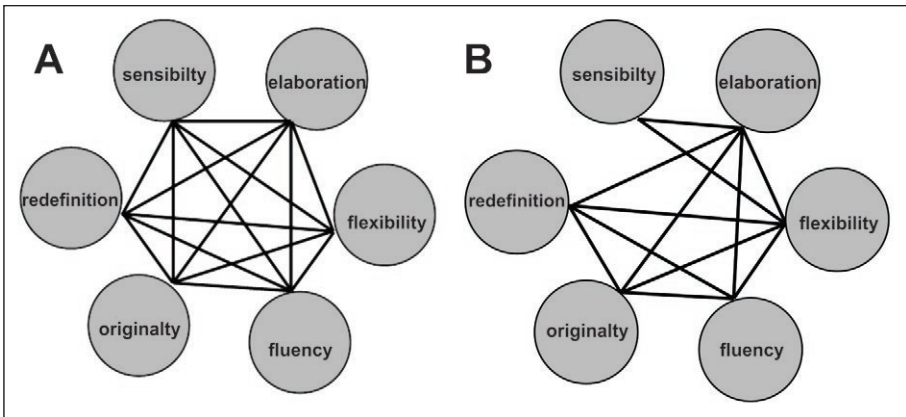


Figure 1: Schematic representation of positive linear correlations among factors of visual art-related creativity. A) All factors of creativity are in linear relationship with each other in boys. B) In girls, drawing-related sensitivity is not in linear relationship with drawing-related fluency, originality and redefinition.

5 Discussion

In the present study, we aimed to determine gender differences in visual art-related creativity in early school-age students by evaluating creativity measures of children’s drawings. We did not find any gender differences in drawing-related creativity. This was further confirmed by the lack of gender differences in the drawing-related elaboration, flexibility, fluency, originality, redefinition

and sensitivity, as well as in progress in visual art-related creativity. However, the number of bivariate linear correlations among factors of visual art-related creativity differed between boys and girls, suggesting gender-specific cognitive styles in the visual arts.

A recent study provided evidence for gender differences in measures of artistic creativity in fifth-grade students⁴⁰. In our pilot study, drawings produced in both the initial and final tests did not differ in respect to visual art-related creativity or factors of drawing-related creativity between boys and girls enrolled in the second grade of primary school. Regarding early school-age students, this is in line with previous observations, which have failed to detect gender differences in creativity in general⁴¹; or in motor creativity⁴²; however, it contradicts studies showing greater creativity in boys⁴³. However, the results of the current study have to be interpreted with caution, because we were not able to control for various factors that could affect visual art-related creativity during the children's early cognitive development, such as parental and professional education⁴⁴. Also, in the same study, we confirmed better verbal skills in girls than boys (unpublished), which is one of the most often confirmed gender differences in humans⁴⁵ and is also established in rats⁴⁶, suggesting that gender differences in visual art-related creativity might be subtle in early school-age students.

Interestingly, the analysis of bivariate linear correlations among the scores of factors of visual art-related creativity quantitatively confirmed previous observations suggesting a positive relationship among the individual factors of

⁴⁰ Herzog, Duh, *Artistic and creative achievements of primary school students...*

⁴¹ P. E. TORRANCE, Kreativnost, *Pedagogija – časopis saveza pedagoških društava Jugoslavije*, 17 (1981) 1-2, 69-87, 70; C. D. LEWIS, J. C. HOUTZ, Gender-role stereotyping and young children's divergent thinking, *Psychological Reports*, 59 (1986) 1027-1033; D. W. CHAN et al., Assessing ideational fluency in primary students in Hong Kong, *Creativity Research Journal*, 13 (2001) 3-4, 359-365; P. C. CHEUNG et al., Creative potential of school children in Hong Kong. Norms of the Wallach-Kogan creativity tests and their implications, *Creativity Research Journal*, 16 (2004) 69-78.

⁴² E. ZACHOPOULOU, A. MAKRI, A developmental perspective of divergent movement ability in early young children, *Early Child Development and Care*, 175 (2005) 85-95.

⁴³ Torrance, *op. cit.*; N. KOGAN, F. T. MORGAN, Task and motivational influences on the assessment of creative and intellectual ability in children, *Genetic Psychology Monographs*, 80 (1969) 1, 91-127; D. W. TEGANO, J. D. MORAN, Gender differences in the original thinking of preschool and elementary school children, *Creativity Research Journal*, 2 (1989) 102-110; Chan et al., *op. cit.*

⁴⁴ Michel, Dudek, *op. cit.*; Sharp, Le Métais, *op. cit.*

⁴⁵ L. ELLIS et al., *op. cit.*, 298; Halpern, *op. cit.*

⁴⁶ J. M. BOWERS et al., Foxp2 mediates gender differences in ultrasonic vocalization by rat pups and directs order of maternal retrieval, *Journal of Neuroscience*, 33 (2013) 8, 3276-3283; <http://doi.org/10.1523/JNEUROSCI.0425-12.2013> (02.08.2017).

visual art-related creativity⁴⁷ and their simultaneous development⁴⁸. Moreover, our results showed a gender difference in the number of bivariate positive linear correlations. While linear positive correlations were found for all pairs of factors of visual art-related creativity in boys, the number of bivariate positive linear correlations in girls was lower. Thus, the score in drawing-related sensitivity was not in linear correlation with the scores in drawing-related originality, fluency and redefinition, suggesting that visual art-related creativity in girls might depend less strongly on emotions (e.g. emotional sensitivity, appreciation of artistic work and artistic beauty) in those drawing tests for creativity that are based on imagination.

Gender differences in the linear relationship among factors of visual art-related creativity, but not in visual art-related creativity might further suggest that boys and girls approach creative tasks by using different cognitive strategies, which can affect creativity⁴⁹, and this might support the observations that males and females reach the same end point by using different strategies⁵⁰. However, the lack of positive linear correlations among pairs of the aforementioned factors in girls does not necessarily mean a lack of nonlinear relationship. The nature of nonlinear correlations is unknown and requires further regression analysis.

Previous developmental studies have reported that children between 6 and 9 years of age exhibit a reduced rate of creative development⁵¹. In the present study, we evaluated creative development over an eight-month period in children between 7 and 8 and did not find any progress in visual art-related creativity. Although the mean score on the final test was lower in boys and higher in girls in comparison to the mean score on the initial test, the difference did not reach statistical significance. In the future, detailed analysis of the progression rate of visual art-related creativity over shorter time periods (e.g. 6 or 12 months) would be required before we will be able to study this aspect of creativity in respect to gender differences.

⁴⁷ L. M. LIU, The relationships between creativity, drawing ability and visual/spatial intelligence. A study of Taiwan's third-grade children, *Asia Pacific Education Review*, 8 (2007) 3, 343-352; doi:10.1007/BF03026464 (05.06.2016).

⁴⁸ Herzog, *op. cit.*

⁴⁹ Abraham, *op. cit.*

⁵⁰ M. M. McCARTHY, A. P. ARNOLD, Gender differences in the brain. What's old and what's new?, in: J. B. Becker et al. (eds.), *Gender differences in the brain. From genes to behaviour*, New York, Oxford University Press, 2008, 15-33.

⁵¹ Karlavaris, *op. cit.*; E. WINNER, Visual-spatial thinking in geometry and the visual arts, *Psychology of Aesthetics, Creativity, and the Arts*, 10 (2016) 1, 56-71.

Conclusions

The existence of gender differences in the human brain and cognitive abilities and skills is a highly debatable issue in modern society. Previous studies on gender differences in human creativity have been inconclusive, with some of them favouring men and others women. The results of the present pilot study did not show any gender differences in visual art-related creativity among second-grade students. However, our results suggest that boys and girls at this stage of cognitive development might employ different cognitive strategies when challenged with drawing tests for creativity. Although this will have to be confirmed on a larger scale, our results present further evidence for the need to control cognitive strategies in experiments dealing with gender differences in creativity.

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Razlike između spolova u linearnoj povezanosti čimbenika likovnog razvoja učenika i učenica u drugom razredu osnovne škole

Sažetak

Prethodna znanstvena istraživanja s učenicima i učenicama osnovnih škola ukazale su na razlike između djevojčica i dječaka u mnogim aspektima dječjeg crteža, uključujući i čimbenike kreativnosti. Donekle ove razlike u spolu nastaju kao posljedica specifičnosti pojedinoga spola u likovnom razvitku djece. Međutim, utjecaj spola na kreativnost nije dostatno određen. U ovoj studiji istražili smo razlike između spolova s obzirom na kreativnosti vezane uz likovnu umjetnost, uključujući i napredak u kreativnom razvitku i provjeravali smo linearne korelacije između pojedinih čimbenika kreativnosti u 18 učenika i učenica drugoga razreda osnovne škole. Likovnu smo kreativnost provjeravali s pomoću testa crteža dva puta u jednoj školskoj godini. Naši rezultati pružaju nova saznanja o specifičnim karakteristikama vezanima uz spol učenika u procesu razvijanja kreativnosti izražene crtežima u ranoj školskoj dobi.

Cljučne riječi: likovna kultura, kreativnost, crtanje, razlike između spolova, osnovna škola.

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