

Motor Development and Painting Creativity of Primary School Children

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ABSTRACT

The purpose of this study was to investigate the relationship between psychomotor development and visual creativity. Thirty students ranging in age from 6 to 7.5 years had participated in the study. For the measurement of psychomotor development, the Degree of Kinetic Performance was used from the application of a Set of four kinetic tests of K.T.K. test (Schillinh & Kiphard, 1974). To measure artistic creativity, three tests were administered which were a combination of the Test Torrance of Creative Thinking (Torrance, 1998) and the Test for Creative Thinking Drawing Production (Urban & Jellen, 2010). Specifically, the Test Torrance of Creative Thinking used the element of completing the circle and in the (Urban & Jellen, 2010) test the element of humor was used, as one of the factors measuring creativity. The tests of creativity were evaluated by two different judges who were visual artists and professors at the School of Fine Arts of the University of Ioannina. The results showed that there was a statistically significant positive correlation between the Degree of Kinetic Performance and artistic creativity and in particular with aptitude, originality and processing. Psychomotor development reveals the inextricable link between mental and motor activities, addresses the whole of the human condition and it is a key area of pre-school and school education of kinetic development with artistic creativity. Future research could also look at an extended sample of the relationship between physical-motor performance and visual creativity in early and late childhood students possibly with a larger number of diagnostic tests.

Keywords: KTK test, motor development, painting creativity.

Published Online: December 14, 2022

ISSN: 2736-4534

DOI : 10.24018/ejedu.2022.3.6.518

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I. INTRODUCTION

Modern societies seek to have creative citizens, that is, individuals adaptable to changing conditions who are distinguished by innovation, a spirit of ingenuity and cooperation, so that they can create socially valuable and useful goods with the best quality of material and spiritual of life being one of the ultimate goals. The key point in all this, according to Xanthakou (1998) is creativity both for the ideas and for the methods and techniques of approach. This social pursuit basically starts from the educational system of every society. The children's learning development in school is approached through different educational activities (play, theoretical knowledge, work activities, practical skills, etc.) which offer several stimuli in a natural way for the development of creativity in children (Honzikova & Krotky, 2017).

Creativity is the ability to produce ideas, technical, artistic, or other products, which are useful, aesthetically beautiful, and meaningful and fit into a given field (Matsumoto, 2015). A systemic approach defines a process that depends on the interaction of three factors, the individual, the cultural and the social field (Csikszentmihalyi, 1999). Creativity is the different way of solving a problem and contains three dimensions: the ability

to produce as many ideas as one can, the flexibility to give as many different ideas as possible and the originality.

It is well known that any creator and any creative process require manual work, i.e., motor actions. According to Zimmer (2007), movement is an important means of human expression in which his whole being participates (thought, emotion, motivation, knowledge, desire). The motor development and creativity of young children are two interrelated developmental processes, especially during the first years of children's lives (Runco, 2007). Motor development is the progressive change in the motor behavior of the individual within the life cycle. It involves constantly adapting to a change in his/her motor skills in a relentless effort to achieve and maintain his/her motor control and motor dexterity (Gallahue, 2002).

The acquisition of stages of motor development by the child affects creativity and one process can be developed through the other one (Vygotsky, 1978). In the Greek scientific field, (Likasas *et al.*, 2003) with their research on the creativity of preschool children concluding that there were statistically significant differences in terms of motor flexibility, ease, and originality, according to the way skills were performed in the group of children who were systematically involved in organized extracurricular physical education activities. The volume of fine mobility

activities in primary school and even more in kindergarten on a daily basis is very large and is most often spent on activities based on the use of paper and pencil (writing, painting, brick construction, etc.). Children's academic success is based on these fine-tuning tasks (Marr *et al.*, 2003). Graphic-motor skills (writing, painting) include the conceptual and perceptual-motor skills necessary for drawing and writing (Ziviani & Wallen, 2006). Painting and writing are complex motor behaviors with which psychomotor, cognitive, mental, and linguistic processes interact with learning and developmental ones (Smits *et al.*, 1997).

According to a study by (Honzikova & Krotky, 2017) conducted in the Czech Republic and had correlated motor development with creativity, it was found that: a) People with high performance in creativity tests weren't found to have high scores in their kinetic development too, b) Motor development is stable or does not change significantly even when repeated at another point and time and c) The performance of creativity may be different each time. The very small number of published works both in the international and in the Greek scientific field directed us to investigate the relationship between motor development and the creativity of school children.

The purpose of this research paper is to investigate in children aged six and seven years, the relationship between motor development and their ability to be creative. Specifically, it will explore the relationship between kinetic performance through the application of a set of kinetic tests and visual painting creations. The research will highlight:

- a) The degree of motor performance of children that reflects their motor development through the application of an appropriate set of motor tests.
- b) The level of children's creativity through appropriate visual painting activities.
- c) The comparison of the performance of the degree motor performance and the level of creative visual ability for each child.

II. CONCEPTUAL DEFINITIONS

The Degree of Motor Performance (DMP) in the present study is the value that the child achieves in all four motor tests and characterizes the level of his motor development (Schmidt & Weisberg, 2009).

Originality is an important element of divergent thinking, with productions that meet the criteria of rarity and uniqueness, the distance from the old (Xanthakou, 2011). Flexibility is the ability to produce a large number of ideas, responses and solutions to a stimulus or problem within a specified time (Xanthakou, 2011).

The ability to process characterizes the position of the individual to make an idea viable, to develop it in its details, to improve it, to complete it or even to make it attractive (Xanthakou, 2011).

Humor is the mood for witty jokes and irony, which is covered with seriousness (Dictionary of the Modern Greek Language. (2008).

III. RESEARCH METHODOLOGY

A. Sample

A total of thirty children ($f=30$ 100%), 16 girls 53.3% and 14 boys 46.7% participated in the study and their ages ranged from 6 to 7.5 years. Prior to the implementation of the research, the authorities of primary education, parents and children were informed about the purpose and method of the research. During the trials, the possibility of their withdrawal was ensured since this was desirable by one of the participants.

B. Research Tools

The Kinetic Performance Score was used for the measurement of kinetic development from the K.T.K. test by (Schilling & Kiphard, 1974), this set of tests is suitable for children aged 5 to 14 years. To measure artistic creativity, three tests were administered which were a combination of the Test Torrance of Creative Thinking (Torrance, 1998) and the Test for Creative Thinking Drawing Production by (Urban & Jellen, 2010). Specifically, from the Test Torrance of Creative Thinking it was used the element of completing the circle and from the Urban & Jellen test it was used the element of humor, as one of the factors measuring creativity.

C. Evaluation of Motor Development (Degree of Motor Performance-DMP)

The 1st test (equilibrium) according to the manufacturers (Schilling & Kiphard, 1974) of KTK test involves walking on a balance beam 3 meters long backwards. The dimensions of the balance beams are 6, 4.5 and 3 cm. Prior to the measurement, test attempts are possible. Three attempts are made on each beam and the number of steps on the beam is recorded. One point is deducted for each step outside the goal. The highest performance that can be recorded is the 8 steps in each attempt and the maximum score on the beams is 72.

In the 2nd test (Jumps) the test taker must make continuous jumps over an obstacle with a load of 1.5 meters. The height of the obstacle is variable starting from zero centimeters and reaching up to 60 centimeters. Immediately after performing the jump, they should continue with at least two bounces with the support leg. The test effort includes 5 jumps on each leg. The initial starting height for children aged 5 to 6 years is 10 cm. For each height and for each leg the child makes three attempts which are scored with 3, 2 and 1 point depending on whether the child succeeded in the first, second or third attempt. It counts as a mistake when the other foot touches the ground, when less than two jumps are made after the obstacle or if the child throws the obstacles. The maximum score is 72, 36 for each foot.

For the 3rd test (Moving the body with right-left jumps) a wooden plate measuring 100×60 cm is required, which is divided in half with a wooden bar 60×4×2 cm. From the balance position, right-left jumps are made for 15 seconds above the divider bar. The test attempt involves five side jumps. Then the total jumps of two attempts are recorded which are added together. The attempt is stopped when the child makes two invalid attempts. Efforts are considered invalid when both legs do not cross during the jump, when the foot comes in contact with the dividing lines or when it

lands outside the limits of the exercise.

For the 4th test (Displacement of plates), two boards of dimensions 25×25×1.5 cm are needed. The student steps with both feet on one plate and bends down, takes the other with his/her hands, places it next to it and steps on it with both feet. This process takes 20 seconds, and it is performed twice. The child can practice with three to five test attempts. The total shifts in both attempts are scored. The child gets one (1) point when he/she has taken the plate from the left and moved it to the right side of the body, and two (2) points when he/she is with both feet on the plate that he/she has moved.

D. Evaluation of Artistic Creativity

To evaluate the activities of artistic creativity, students were given three different tests. The students' evaluation of schematic tests assesses students' ability to evolve, enrich and process an idea. Children are asked to create an image based on a shape given to them as a stimulus.

In the 1st test (Equilateral triangle) the students were given an A4 page where in the center there was an equilateral triangle. Students are invited from taking this shape into consideration to draw something special and create an original image having included in the painting this triangle, that is, to be part of their painting.

In the 2nd test (Circle) the students were given an A4 page where in the center there was a small circle. Students are asked to create an image by stimulating the circle and complete the project by creating a perfected drawing.

In the 3rd test (Various lines), three lines, one horizontal, one vertical and one alternating curve, were given as a stimulus to start the creative process. The procedure was the same as the above tests as students are asked to form as complex and unusual a picture as possible.

The scoring of the three tests was done on a six-point scale, as follows: a) Ease, originality, processing, movement, and humor took the values from zero to 5 (0-5). Specifically, for the observers' observations, the children received the value "0" for "not at all," the value "1" for "very little," the value "2" for a little, the value "3" for "not a little, not much," the value "4" for a lot "and the value" 5 "for" too much." The shapes were graded and given the value "1" for the basics, the value "2" for the curvilinear and the value "3" for the mixed ones. The size of the painting was also graded, and it received the value "1" for the small and the value "2" for the large. The colors also got the value "1" for the appearance in the painting of a small number of colors and the value "2" for the many for the appearance of too many colors.

The evaluation of the creativity tests was carried out by two special evaluators, professors at the University of Ioannina of the School of Fine Arts and the Pedagogical Department of Kindergarten Teachers whose subject was "Visual Arts." In the present research work the children were asked to complete an unfinished project and, in this way, to express the divergent thinking together and some of the qualitative elements of creativity, such as dexterity, originality, editing ability, the ability to develop a design, the movement within the design, humor, shapes, size and colors. The qualitative elements rated by the two expert evaluators were ease, originality, editing ability, design

development ability (i.e., adding new elements to the project), movement, humor, shapes, size, and number of colors used.

IV. RESEARCH RESULTS

A. Results For the Degree of Motor Performance (DMP)

The Kolmogorov Smirnov regularity test for each of the four tests as well as for the entire KTK test showed values of p (2-tailed) >0.05 , which means that in the motor responses of the children there is a normal distribution of values (e.g., see in Table I).

TABLE I: CHECKING THE NORMALITY OF THE VALUES FOR THE MOTOR RESPONSES OF THE SAMPLE FOR THE KTK TEST

KTK Test	One-Sample Kolmogorov-Smirnov Test				
	KTK 1	KTK 2	KTK 3	KTK 4	TOTAL
Test Statistic	0.122	0.088	0.131	0.103	0.104
Asymp. Sig. (2-tailed)	0.200	0.200	0.197	0.200	0.200

Cronbach's reliability index for the total of the four KTK test tests for the entire survey sample (N=30, 100%) showed a value of 0.720 which means that indeed the four KTK test measures the same psychometric characteristic, are highly consistent or correlation, both with each other and with this feature of motor coordination. Below shows the descriptive features of the KTK test (e.g., see in Table II).

TABLE II: MEANS, STANDARD DEVIATION, MIN, MAX OF KTK TEST (N=30, 100%)

KTK Test	N	Min	Max	Mean	Std Dev.
KTK 1	30	34	67	54.733	8.796
KTK 2	30	0	96	46.300	22.963
KTK 3	30	11	64	36.567	15.433
KTK 4	30	21	48	35.900	6.222
TOTAL	30	80	260	173.500	43.775

B. Effects of Creativity

Two experts evaluated the children's artistic creations for the eight dimensions that concerned creativity (e.g., see in Table III). The double evaluation was performed for reasons of validity with the Cohen Kappa coefficient used to measure the agreement between two appraisers. The values as shown in Table III range from 0.763 to value 1, which means that there is a high agreement between the two judges (e.g., see in Table III).

Factor analysis of key components for the correlations of the eight variables of creativity was performed (e.g., see in Table IV). First, two factors were extracted with rooticals equal to or greater than 1.00. The orthogonal rotation of the factors gave the structure shown in Table IV. The first factor is responsible for 72% of the variance and the second for 28%. The first factor seems to be the productive-processing and the second the geometric-schematic.

C. Results of Correlations of the Variables of Motor Development (DMP) and Creativity

From the analysis of the Pearson Correlations (r) between the KTK test and the eight variables of creativity, as shown in Table V it appears that (ease) and (originality) have a

TABLE III: FREQUENCIES AND PERCENTAGES OF THE TWO ESTIMATORS FOR THE FACTORS OF ARTISTIC CREATIVITY AND COHEN'S KAPPA COEFFICIENT FOR THEIR AGREEMENT

Artistic creativity, Painting		1 st Evaluator		2 nd Evaluator		Kappa Cohen
		<i>f</i>	%	<i>f</i>	%	
Ease	At all					0.903
	Very Little	8	26.70	7	23.30	
	Little	7	23.30	9	30.00	
	Very	13	43.30	12	40.00	
	Too much	2	6.70	2	6.70	0.787
	At all	5	16.70	4	13.30	
	Very Little	6	20.00	6	20.00	
	Little	4	13.30	5	16.70	
Originality	Very	9	30.00	10	33.30	0.880
	Too much	6	20.00	5	16.70	
	At all	1	3.30	1	3.30	
	Very Little	10	30.00	9	30.00	
Processing	Little	6	16.70	7	23.30	0.911
	Very	11	30.00	11	36.70	
	Too much	2	20.00	2	6.70	
	At all	1	3.30	1	3.30	
Movement	Very Little	9	30.00	8	26.70	0.763
	Little	5	16.70	6	20.00	
	Very	9	30.00	10	33.30	
	Too much	6	20.00	5	16.70	
Humor	At all	18	60.00	18	60.00	1.000
	Very Little	8	26.70	8	26.70	
	Little	1	3.30	1	3.30	
	Very	1	3.30	1	3.30	
	Too much	2	6.70	2	6.70	1.000
	At all					
	Very Little	2	6.70	2	6.70	
	Little					
Shapes	Very	28	93.30	28	46.70	1.000
	Too much					
	At all					
	Very Little					
Size	Little	6	20.00	6	20.00	1.000
	Very	24	80.00	24	80.00	
	Too much					
	At all					
Color	Very Little					0.867
	Little	16	53.30	14	46.70	
	Very	14	46.70	16	53.30	
	Too much					

TABLE IV: RECTANGULAR FACTOR CHARGE MATRIX FOR EIGHT VARIABLES

Variables	1 st Factor	2 nd Factor
Ease	0.883	0.386
Originality	0.871	0.438
Processing	0.905	0.352
Movement	0.893	0.381
Humour	0.860	-0.020
Shapes	0.078	0.896
Size	0.413	0.771
Colour	0.897	0.178

statistically significant and positive correlation with the dimensions KTK1, KTK2, KTK3 and with the total KTK. Therefore, higher values (ease) and (originality) are expected for higher values of the specific KTK tests. The conclusions are similar for the (processing) without; however, its correlation with the KTK3 test is important. Also, the correlation of the dimension (figures) with the KTK4 test was found to be statistically significant and

positive.

V. CONCLUSIONS

The purpose of this study was to investigate in primary school students the relationship between motor development and their ability to be creative. Specifically, to investigate the relationship between the degree of motor performance through the application of psychomotor tests and visual creations. The statistical analysis of the research data showed that in general there is a direct correlation between these two parameters. In particular, it seems that (ease) and (originality) which are among the most important parameters of creativity have a statistically significant and positive correlation with the KTK-test with the first (KTK-1), the second (KTK-2) and the Tuesday (KTK-3) test but also, with all the KTK tests. The research of Honzikova and Krotky (2017) is relevant to the subject of the present study

TABLE V: CORRELATION WITH PEARSON CORRELATION (R) COEFFICIENT AT 95% CONFIDENCE LEVEL OF VARIABLES OF MOTOR DEVELOPMENT (DMP) AND VISUAL CREATIVITY FOR THE ENTIRE RESEARCH SAMPLE N=30, 100%

Creativity painting	Pearson correlation	KTK TEST				
		1	2	3	4	Total
Ease	r	0.481	0.440	0.393	0.308	0.510
	Sig. (2 tailed)	0.007	0.015	0.032	0.098	0.004
	N	30	30	30	30	30
Originality	r	0.372	0.495	0.484	0.250	0.540
	Sig. (2 tailed)	0.043	0.005	0.007	0.184	0.002
	N	30	30	30	30	30
Processing	r	0.523	0.455	0.334	0.194	0.489
	Sig. (2 tailed)	0.003	0.011	0.071	0.305	0.006
	N	30	30	30	30	30
Movement	r	-0.263	0.217	0.053	0.274	0.119
	Sig. (2 tailed)	0.161	0.249	0.781	0.144	0.532
	N	30	30	30	30	30
Humor	r	-0.104	0.265	0.039	0.256	0.168
	Sig. (2 tailed)	0.586	0.157	0.838	0.172	0.374
	N	30	30	30	30	30
Shapes	r	-0.271	0.344	0.150	0.384	0.233
	Sig. (2 tailed)	0.147	0.063	0.429	0.036	0.215
	N	30	30	30	30	30
Size	r	-0.015	0.055	-0.053	0.196	0.035
	Sig. (2 tailed)	0.936	0.774	0.782	0.299	0.855
	N	30	30	30	30	30
Color	r	0.211	0.243	0.009	0.258	0.210
	Sig. (2 tailed)	0.264	0.195	0.964	0.169	0.266
	N	30	30	30	30	30

and its results showed that students with high performance in creativity showed low performance of the degree of motor performance and in fact the results were below average. This difference in the results of the two surveys can be explained initially by the fact that the surveys were conducted at different ages. The present study concerned students aged six to seven years, while the research of (Honzikova & Krotky, 2017) concerned students aged 10 to 14 years as well as students. According to (Xanthakou, 2011), a decline in the creative ability of the child during the 9th to 10th year of life has been observed, as a consequence of school conditions that discourage creative thinking. Motor skills can be developed and improved through education (Zaragas, 2011; Zimmer, 2007; Drakos & Binias, 2010). The difference in the results of the above research (of the present study and of (Honzikova & Krotky, 2017) may be due to the lack, in the absence of motor experiences. It is necessary to think about the content of the education we want to have. It has been shown that children instinctively research, examine and discover the world with their body and the movements they make. Through this interaction the child develops and improves kinetically. Therefore, education is necessary to offer the appropriate conditions that favor freedom, self-action and experimentation that will result not only in the acquisition of knowledge but also in problem solving and the activation of their creative abilities (Tsapakidou, *et al.*, 2003).

It is obvious that if we want students to be able to use their creativity which means to be able to have divergent and critical thinking, they must be fueled by motivation and ideas. The same goes for psychomotor development which evolves and improves with education. The more opportunities children have for them, the better their psychomotor development can be.

Activating creative thinking contributes to the development of functional skills by enhancing the

production of new ideas and problem solutions. The application of methods that develop creative thinking contributes significantly to improving the quality of life towards the development and completion of the child's personality. In this way they are shaped with those conditions that lead children to think systematically and creatively in all forms of the educational process while improving and developing their motor and physical abilities (Likasas, *et al.* 2003). However, the originality of early childhood is gradually declining with many studies showing a decline in the child's creativity around the fourth grade of elementary school. In order to avoid the reduction of creativity in school, the child should be submitted to different types of learning and not to a standardized way of teaching (Xanthakou, 1998).

The teacher should be a helper and an ardent supporter of the child's creative development with his / her contribution playing a decisive role for the student who wants to express himself/herself in the classroom. The teacher should be able to use the creative talents he has in his hands and know which actions encourage a creative behavior and which ones inhibit it while the teacher should give opportunities for expression to all students without exception. Significant value for the expression of creativity is the creation of an appropriate environment of communication, where fear and complete guidance from the adult will not prevail and the child will be motivated to create. The teacher who embraces creative pedagogy must willingly accept the ideas of children, trying to implement them in the classroom, accepting unexpected questions, promoting collaboration, creating an atmosphere of initiative and active participation, and not clinging to pure events. On the other hand, psychomotor development reveals the inseparable relationship between mental and motor activities addresses the totality of the human condition and is a key area of preschool education (Mpourneli, 2002). It is therefore

considered necessary to introduce psychomotor education programs in kindergarten and elementary school if we want our students to have complete personality development. In conclusion, today's education should prepare children for an ever-changing future (Robinson, 2011). Future research could also look at an extended sample of the relationship between physical-motor performance and visual creativity in early and late childhood students possibly with a larger number of diagnostic tests. Closing this work, we want to point out that psychomotor development and creativity are a challenging endeavor for the teacher who can combine the knowledge in the best way so as to deliver to the state complete personalities, personalities who will be able to apply their own ideas not only in their daily lives but also on a higher level to improve the quality of human life.

APPENDIX



Fig. 1. Children's creative drawing board.

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