

Analysis of Motor and Cognitive Development in Early Childhood by Gender and Learning Styles Through Drawing and Coloring Activity

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Abstrak: *Motor and cognitive development of children is very important to improve for their success in the future. This study aims to find out the development of motor and cognitive skills in early childhood by gender and learning styles through drawing and coloring activity. The subjects in this study were children aged 5-6 years consisting of 27 boys and 25 girls who attend Early Childhood Education (PAUD) in Purwoasri, Kediri Regency. This study used an experimental design. The learning styles questionnaire developed by the researcher refers to the learning style theory indicators developed by DePorter & Hernacki, (2007) which are used to identify and classify children learning styles into visual, auditory, and kinesthetic. The children's fine motor and cognitive skills were measured by assessing their ability to draw and color a picture in a worksheet. The results of the analysis using the independent T-Test sample showed that a significance value of 0,047 for drawing and 0,036 for coloring ($p < 0.05$) in terms of gender, it means there was a difference in motor and cognitive skills used in drawing and coloring activity. The results of the One-way ANOVA analysis showed that there was no significant difference in drawing ability between the three groups of learning styles. However, a significant difference in coloring ability was found between the visual and kinesthetic groups with significance value of 0,038 ($p < 0,05$).*

Kata Kunci: *drawing; coloring; gender; learning styles; motor; cognitive; early childhood.*

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INTRODUCTION

The ability to draw and color is an indicator of physical and cognitive development of early childhood which is important in the study of developmental psychology. Emotional condition also affects

the ability to draw. Drawing and coloring are the representation and reflection of every child. Drawing is the most important part of children's cognitive development and expression (Cherney, Seiwert, Dickey, & Flichtbeil, 2006). Burkitt & Sheppard (2013)

stated that feelings of happiness, sadness, and mixed emotions affect children's cognitive skills when they draw and color. Drawing, coloring, and playing with crayons are interesting and fun activities which never make children bored (Santrock, 2000a). According to Santrok (2009), the aspects of individual development include physical, cognitive, language, emotional, social, moral, and creative development. The development of a child is a part of biological, cognitive, social, and emotional process (Santrock, 2000b). Santrock adds that the development of motor skills in children aged 5-6 years is a pivotal asset for children's physical development to improve their skills when they grow up.

It is crucial to hone and develop fine and gross motor skills. Hestbaek et al., (2017) explain that exercise and physical activity in early childhood are essential for muscles and cognitive development. Children will be able to control their physical organs when they are often trained with various activities and games because they are closely related to social development and physiological maturity of children (Dehghan, Mirzakhani, Rezaee, & Tabatabaee, 2017). Children's psychological, physical, and motor development can also affect cognitive, emotional, and language development (Gonzalez, Alvarez, & Nelson, 2019).

Drawing and coloring are the manifestation of creativity and art that children possess. To date, numerous studies have examined the development of fine motor skills through drawing and coloring activity. The research conducted by Hartati (2014) showed that drawing and coloring can significantly improve the fine motor skills of children aged 5-6 years. Furthermore, Tiara, Yusuf, & Tristiana (2019), Evivani & Oktaria (2020), Sukarini (2020) reported that coloring activity using finger painting technique has a significant effect on children's cognitive and fine motor

skills. Improving fine motor skills in children can also be carried out through various activities such as beading (Jannah, 2019), paper quilling (Wahyuningtyas, Nugroho, & Lestaringrum, 2020), squeezing newspapers (Budiarti, Lestaringrum, & Nugroho, 2020).

The development of fine and gross motor skills in children is influenced by gender differences. Girls demonstrate a better performance than boys. However, it was also shown that boys' gross motor skills are better than girls' (Pahlevanian & Ahmadizadeh, 2014). These findings are confirmed by the research results of Hammer (1997), suggesting that girls draw in a more controlled way than boys. Boys show less control in drawing because their drawing is bigger than girls' drawing.

Learning outcomes achieved by children are affected by several factors including age, study habits, intelligence, motivation, and learning styles. The ability of children to imitate drawing the picture shown by the teacher and choose colors cannot be separated from the modality or learning styles they have. Learning style is an individual's way of absorbing, organizing, and processing information (DePorter & Hernacki, 2007). Learning styles are the primary focus in literature review and educational psychology (Claxton & Murrell, 1987).

In general, there are three types of learning styles that individuals possess, i.e. visual, auditory, and kinesthetic (DePorter & Hernacki, 2007). Visual learners prefer neatness, books, images, and videos. Moreover, they pay careful attention to details, have a strong memory because of reading, have a long attention span, are not easily distracted by noises, always observe expressions and body language when a person is talking, prefer reading to absorb information. Auditory learners tend to prefer verbal explanation, music, discussion, group work, conversation, reading aloud,

imitating tones or sounds. Kinesthetic learners have the characteristics of speaking slowly, touching people to attract attention, moving actively, memorizing things easily by seeing and walking, using their fingers for pointing what they read, preferring games that keep them busy. Moreover, there is a possibility that their handwriting is poor.

In learning process, the major factor affecting the ability to absorb information is senses. Each individual has different sensation and perception in receiving information because their learning styles and physical motor skills are different. Whether a child wants to draw or not is strongly influenced by the child's ability to observe and process an object. The results of the research conducted by Fox & Lee (2013) reported that children's observational skills can affect their ability to grasp an object and their motivation when drawing. For example, when children are given an example of how to draw a picture by their teacher, the result of their drawing will certainly differ from that of their teacher. It can be better, the same or similar, a little different, and even completely different.

Similarly, it also applies in coloring and selecting colors. Each child definitely shows a different result in coloring a picture, and the score is adjusted to the logical and expressive color selection ability (Drosinos, 2006). In his book, Piaget provides assumptions on children's cognitive skills in selecting colors. Children tend to choose expressive colors over logical colors when coloring pictures. Girls are more capable of choosing expressive colors than boys, and the ability to choose logical colors is also determined by age (Piaget, J., & Inhelder, 1971).

Based on these research findings, the researcher was encouraged to formulate research questions as follows: 1) are there any differences in children's motor and cognitive skills in drawing and coloring activity in terms of gender? 2) are there any

differences in children's motor and cognitive skills in drawing and coloring activity in terms of learning styles?

RESEARCH METHODS

This research was designed as experimental research. Fifty-two children (27 boys and 25 girls) participated in the study. Their age range is 5-6 years. These children are from two classes in group B at ANADHIFA Kindergarten (TK), KUSUMA MULIA Kindergarten (TK), and PERWANIDA Kindergarten (TK) in Purwoasri, Kediri. The variables in this study were gender, learning styles, drawing and coloring ability.

Two instruments were used in this study. The research data were collected through observation by filling out a prepared questionnaire. Firstly, a learning style questionnaire adopted from learning styles theory of DePorter & Hernacki (2007) was developed by the researcher to identify and classify the children's learning styles into three groups (visual, auditory, and kinesthetic). Each learning style consisted of 10 items, so in total there were 30 items for three types of learning styles. The learning style questionnaire was filled out by the teachers and researcher during classroom learning by ticking one option of "yes" or "no". The learning style with the most selected items indicated the group into which each child was classified. From the observation and questionnaire results, it was found that 15 children preferred visual learning style, 18 children preferred auditory learning style, and 19 children preferred kinesthetic learning style.

Secondly, drawing and coloring worksheet was used as a data collection instrument. The children's drawing results were assessed by the teachers and researcher based on the assessment theory adopted from the drawing theory of Cherney et al (2006) and Drosinos (2006). The scoring developed by the researcher was as follows: score 4: more creative than the sample image, score 3: similar to the sample image,

score 2: a little different from the sample image, score 1: completely different from the sample image. Thirdly, the data were obtained from coloring worksheet. The children's coloring results were assessed by the teachers and researcher based on the indicators adopted from Piaget, J., & Inhelder (1971) consisting of two types of assessment criteria. The first is whether the color selection is logical (score 2) or illogical (score 1). The second is whether the color selection is expressive (score 2) or less expressive (score 1).

The data obtained were analyzed using SPSS version 16.0. The independent sample T-Test using SPSS was used to determine whether there are any significant differences in drawing and coloring ability by gender. One-way Anova was used in data analysis to compare and find out whether

there are significant differences in drawing and coloring ability by gender and learning styles.

RESULTS AND DISCUSSION

Results

Descriptive analysis of drawing and coloring ability by gender

Table 1 shows the mean score of drawing and coloring ability by gender. There were 27 children in the boys group and 25 children in the girls group. In the drawing test, the boys group and the girls group had a mean score of 3.15 and 3.37, respectively. Furthermore, in the coloring test, the boys group obtained a mean score of 2.96, while the girls group obtained a mean score of 3.28.

Table 1.
Statistical description of the mean score of drawing and coloring ability by gender

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
DRAWING SCORE	Boys	27	3.15	.534	.103	2.94	3.36	2	4
	Girls	25	3.37	.754	.151	3.06	3.68	1	4
	Total	52	3.25	.652	.090	3.07	3.44	1	4
COLORING SCORE	Boys	27	2.96	.649	.125	2.71	3.22	1	4
	Girls	25	3.28	.737	.147	2.98	3.58	2	4
	Total	52	3.12	.704	.098	2.92	3.31	1	4

Table 1 shows that in terms of drawing ability, the girls have a higher mean score compared to the boys with a difference value of 0.22. Moreover, regarding coloring ability, the girls show a higher mean score than the boys with a difference value of 0.32. The difference test results using the independent sample t-test showed a

significance value of 0.047 ($0.047 < 0.05$), meaning that there was a significant difference in drawing ability. Likewise, the coloring ability showed a significance value of 0.036 ($0.036 < 0.05$), meaning that there was also a significant difference in coloring ability. The results can be seen in Table 2 and Table 3.

Table 2. Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2- tailed)	Mean Differen ce	Std. Error Differen ce	95% Confidence Interval of the Difference	
								Lower		Upper
DRAWING SCORE	Equal variances assumed	4.134	.047	-1.232	50	.224	-.222	.180	-.584	.140
	Equal variances not assumed			-1.216	42.916	.231	-.222	.182	-.590	.146

Table 3. Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2- tailed)	Mean Differenc e	Std. Error Differenc e	95% Confidence Interval of the Difference	
								Lower		Upper
COLORING SCORE	Equal variances assumed	4.657	.036	-1.649	50	.106	-.317	.192	-.703	.069
	Equal variances not assumed			-1.640	48.004	.107	-.317	.193	-.706	.072

Descriptive analysis of drawing and coloring ability by learning styles

Table 4 shows the mean score of drawing and coloring ability of each learning style group. There were 15 children in the visual group, 18 children in the auditory group, and 19 children in the kinesthetic

group. In the drawing test, the visual, auditory, and kinesthetic group obtained a mean value of 3.47, 3.28, and 3.07, respectively. Furthermore, the coloring test results showed that the visual, auditory, and kinesthetic group obtained a mean value of 3.40, 3.11, and 2.89, respectively.

Table 4.
Statistical description of the mean score of drawing and coloring ability by learning styles

	Learning Styles	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean			
						Lower Bound	Upper Bound	Minimum	Maximum
DRAWING SCORE	Visual	15	3.47	.640	.165	3.11	3.82	2	4
	Auditory	18	3.28	.669	.158	2.95	3.61	2	4
	Kinesthetic	19	3.07	.623	.143	2.77	3.37	1	4
	Total	52	3.25	.652	.090	3.07	3.44	1	4
COLORING SCORE	Visual	15	3.40	.507	.131	3.12	3.68	3	4
	Auditory	18	3.11	.758	.179	2.73	3.49	2	4
	Kinesthetic	19	2.89	.737	.169	2.54	3.25	1	4
	Total	52	3.12	.704	.098	2.92	3.31	1	4

Table 4 shows that the visual group has the best performance in drawing, followed by the auditory, and kinesthetic group. Similarly, in terms of coloring ability, the visual group also shows the highest mean score compared to the auditory and kinesthetic group.

Analysis of drawing and coloring ability between visual, auditory, and kinesthetic learning style group

Table 5 shows the significance value of drawing and coloring ability among the three learning style groups. The results of One-way Anova on the drawing and coloring ability can be seen in table 5.

Table 5. Differences in drawing and coloring ability of learning style groups

LSD

Dependent Variable	(I) LEARNING STYLES	(J) LEARNING STYLES	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
DRAWING SCORE	Visual	Auditory	.189	.225	.406	-.26	.64
		Kinesthetic	.401	.222	.078	-.05	.85
	Auditory	Visual	-.189	.225	.406	-.64	.26
		Kinesthetic	.212	.212	.322	-.21	.64
	Kinesthetic	Visual	-.401	.222	.078	-.85	.05
		Auditory	-.212	.212	.322	-.64	.21
COLORING SCORE	Visual	Auditory	.289	.240	.235	-.19	.77
		Kinesthetic	.505*	.237	.038	.03	.98
	Auditory	Visual	-.289	.240	.235	-.77	.19
		Kinesthetic	.216	.226	.343	-.24	.67
	Kinesthetic	Visual	-.505*	.237	.038	-.98	-.03
		Auditory	-.216	.226	.343	-.67	.24

It can be seen from Table 5 that there is no significant difference in the drawing ability among the three types of learning style groups. However, there is a significant difference in the coloring ability where $p = 0.038$ ($0.038 < 0.05$). It means that there is a difference in coloring ability between the visual and kinesthetic group. Additionally, it can also be seen that there is no significant difference in coloring ability between the visual and auditory group as well as between the auditory and kinesthetic group.

Discussion

The research findings revealed that the children's motor and cognitive skills in drawing and coloring activity by gender showed a mean score difference. The results of the analysis revealed that the girls showed a better performance in drawing and coloring than the boys. This is in accordance with the opinion of (Piaget & Inhelder, 1969), stating that girls have more expressive drawing and coloring skills. Similarly, (Hammer, 1997) He stated that girls' motor control skills in drawing are better than boys'. This finding is strengthened by the research finding of (Pahlevanian & Ahmadizadeh, 2014), revealing that girls' fine motor skills are better than boys', while boys' gross motor skills are better than girls'. On the contrary, the research conducted by (Pennington, 2002) concluded that there is no difference in drawing ability between genders.

The research results related to the drawing ability of the learning style groups showed that there was no significant difference between the visual, auditory, and kinesthetic learners. The three groups of learners have equal ability although statistically, the mean score of the three groups are in a sequential order from visual, auditory to kinesthetic group. The obtained mean scores did not indicate differences because the significance value exceeded 0.05.

Regarding the coloring ability, it was found that there was a significant difference between the visual and kinesthetic group with a significance value of $0.038 < 0.05$. It means that in this study the visual group has a better coloring ability than the kinesthetic group. This result concurs with the idea of (Reid, 2005; Wood, 2000), stating that visual learners have the ability in visual graphic realism that underlies their cognitive process. Therefore, they have the best drawing and coloring ability. In addition, they also have a good visual spatial relationship with their memory in capturing patterns and colors of an object in the form of images.

Drawing and coloring involve memory, experience, imagination, and observation (Brooks, 2009). Drawing and coloring involve not only physical, motor aspect but also cognitive aspect in the form of visual perception that generates a product. Children who practise drawing and coloring regularly will improve their fine motor skills, be able to develop eye-hand coordination to carry out the required cognitive and motor functions, be able to hold a pencil correctly, and exercise fine muscles in the fingers (Kurniawati, Hastuti, & Prehedhiono, 2018; Putra & Pintari, 2019). Several positive effects of drawing and coloring practice include improving fine motor strength of the hands, stimulating children's creativity, encouraging self-expression, improving fine motor coordination, improving focus skills, and preparing children's writing skills.

In their research, (Saparahuningsih & Badeni, 2018) reported that coloring can improve fine motor skills in the finger muscles, and with regular practice it can improve children's mental concentration, enable children to color a picture fully, neatly and precisely. In addition, in their research, (Quaglia, Longobardi, Iotti, & Prino, 2015) revealed that children's ability to draw and color is also influenced by emotional factors, practice, and equipment that children have.

They state that older people such as teachers and parents must appreciate and support any results that children achieve and provide assistance in free directed drawing and coloring. It is because every dynamic and emotional stroke is profoundly influential on children's physical and cognitive development.

CONCLUSION

Based on the research results and discussion, it can be concluded that there was a difference in the mean score of drawing and coloring ability between the boys and girls in early childhood. The girls have better drawing and coloring skills than the boys. On the other hand, in terms of learning style differences, there was no significant difference in drawing ability between the visual, auditory, and kinesthetic group. Regarding the coloring ability, it was found that there was a significant difference between the visual and kinesthetic group, but there was no significant difference in coloring ability between the visual and auditory group. Based on the mean score of the ability to draw and color obtained in the research, it can be seen that the visual group has the best performance, followed by the auditory group, and kinesthetic group.

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