

THE INFLUENCE OF PAINT PLAY ACTIVITIES ON KNOWLEDGE AND PREFERENCE FOR COLORS IN PRESCHOOL CHILDREN IN HEALTH CONTEXT

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Abstrakt

The purpose of this research was to clarify the importance of paint play activities in early childhood education through investigating the influence of children's paint play activities on their knowledge and preference for colors. Thirty-four four-year-old children were induced to mix various colors to create their favorite colors and to draw freely in "a tree hut", conical white monument, and in a sheet of paper. Before and after such paint play activities, the children were given a naming task which asked children to answer the name of colors, a free utterance task which asked children to answer their favorite colors, and a selection task which asked children to choose the favorite colors out of their choices. The results showed that the children's knowledge of color has a statistical tendency to increase after the activity and also the number of children's favorite colors increased significantly in both tasks after that. These results suggest that the paint play activities have a positive influence on knowledge and preference for colors in preschool children.

Keywords

Health, creativity, paint play activity, knowledge of color, preference for color

INTRODUCTION

Japanese early childhood education is regulated by Kindergarten Education Procedure which is published from Japanese Ministry of Education. This procedure shows that there are five aspects which should be involved in early childhood education: Health (physical and mental health); Human Relationships (the relationship between the child and other people); Environment (children's surroundings, and relationship to them); Language (the process of language acquisition); and Expression (feelings and expression). One of the aims of Expression is "To develop a deep sense of the beauty and other qualities of various things" (Ministry of Education, Culture, Sports, Science and Technology in Japan, 2018). Although there are many characteristics in our environment, the color seems to be important for us to live actively. To have knowledge about colors

and to have favorite colors for preschool children might be important to develop a deep sense of the beauty. Authors Khodabakhshi, Vazifehdar, Bahari, Akbari (2016) accent the positive impact of painting in the context that painting therapy plays a vital role to reduce anxiety and anger. It leads to express negative emotion in nonverbal form.

As for the research which considered the color recognition of small children, Matsuoka (1961) showed 4, 5, and 6-year-old children a sheet of colored paper and asked them the color name of the paper. The results showed that no less than 80% of 4-year-old children had answered correctly as for pink, white, yellow, and black. A similar research was done by Matsumura and Nakata (1991) in which 3, 4 and 5-year-old children were shown a sheet of colored paper and asked the color name of the paper. The results showed that no less than 80% of 4-year-

old children had answered correctly as for red, yellow, blue and white. Shimada (2005) examined the knowledge about color in a wide-range age group of children. She showed 3, 4, 5 and 6-year-old children a sample of 21 colors and asked them as for the color name. Although age difference was not reported in this study, the high rate correct answer of the color was yellow, orange, blue, black, purple, white, and red.

Thus, the previous research of the color recognition in young children had shown no consistent results in terms of the age difference and the frequency of color usage. As for the possible explanation of this research evidence, the kind of or the number of colors which was shown as a stimulus was not consistent in these studies, and also the influence of environmental conditions at the time of investigation might be present. Although in the research on perception of color information on the brightness of the surveyed place have been reported in detail, considering that the color perception is affected by conditions such as whether it was done under natural light or under artificial light such as fluorescent light (Morishita & Omi, 2004; Nakanishi & Matsumura, 2002), such information was not necessarily specified in the conventional research on color recognition of small children. That the difference in the environmental condition at the time of investigation has not been considered may be one cause of inconsistent results by which the unified interpretation about the results of young children's color recognition is hard to be obtained. Moreover, the evidence that the way of thinking about colors may vary from society to society (Fukui, 1991) may influence on the color recognition of children, and the reason why the results were not consistent may be explained by cultural differences such as the preference of young children prevalent at the time of survey.

Knowing the standardized color

name by young children is important not only for noticing the color, but also for thinking about colors and conveying the feelings and thoughts about colors to others. And also it is important for children to be able to express a wide variety of colors around the environment using their vocabulary beyond standardized color names. It means that young children can be able to recognize the world surrounding themselves with rich sensibility. In this research, kindergarten children were asked to mix various colors in a free painting, and to perform the free paint play activity, choosing their favorite objects by themselves. Through such experiences, it was expected that young children could be able to recognize the diversity of colors and to confirm the vocabulary used to represent properly various color environments.

Ohashi (2007) examined 5- and 6-year-old children's color preference using the paired comparison method. He reported that boys in these ages liked green the most, and the order was followed by blue, yellow, purple, orange, red, and girls in these ages liked red the most, and the order was followed by blue, green, yellow, purple, and orange. Sakai, Ando, Murata, and Sato (2005) investigated the color preference of the school bag for 5- and 6-year-old children. As a result of letting them choose their favorite color of the school bag among ten colors, the boys chose light blue the most, and the order was followed by blue, green, red, black, purple, and the girls chose pink the most, the order was followed by red and yellow. Besides these researches, Imada (1926) investigated children's color preference using six sheets of different colored paper and reported that 6-year-old boys liked purple the most, the order of preference was followed by blue, red, yellow, green, and orange, and 6-year-old girls also liked purple the most, the order of preference was followed by red, blue, yellow, green, and orange.

The inconsistency of the results as a whole may be derived from some factors such as the kind and the number of colors used as stimuli for choices which were different from study to study. Moreover, it is said that the color preference may be influenced largely by culture, religion, thought, custom, climate which were accompanied by current cultural trends, and that the social change happens dynamically in conjunction with change of times (Kaneko,1994; Oyama,1994). If we think from such knowledge, primarily it may be difficult to summarize the research findings about the color preference in young children in some consistency. From a viewpoint of early childhood education, it seems to be more important that young children prefer colors differently, because the young children's deep sense of the beauty to various objects may grow up with the interested color as a starting point. And thus it is important not only to clarify the color that young children prefer, but also to consider the factors that encourage their preference for color. This is because young children's broad interest in color leads to interest in everything in the world which surrounds them. The paint play activity carried out in this study was induced young children to mix colors freely and choose objects freely under the educational environment that guarantees the voluntariness of them. Through such voluntary activities, it was expected that the interest in the color of young children would be expanded.

2 OBJECTIVES, PURPOSE

The first purpose of this study was to examine the possibility that the paint play activity focused on mixing colors in an experimentally provided environment could be able to influence on and enrich the color recognition in young children.

The second purpose of this research was to examine the influence of paint play activity which induced to focusing on mixed-colors experiences on color preference in young children.

3 METHODS

3.1 Participants

Thirty eight 4-year-old children (26 boys and 12 girls) of a kindergarten in a local city in Japan participated for this study. The average age at the time of pre-activity task was 4 years and 11 months (range:4:7~5:6). For the analysis of the responses to the pre- and post-activity tasks of paint play activities, out of the whole participants 34 children who received both of tasks (23 boys and 11 girls) were used.

3.2 Research study organization

3.2.1 Pre- and post-tasks of paint play activity

Participants were presented with 15 sample cards and a sample board before and after the paint play activities. Fifteen sample cards, in each of which one color was painted, were backed by the styrene board (10 cm x 10 cm). A sample board was A4 sized, and samples of 15 colors were lined up on it.

Fifteen colors were used as materials for pre- and post-tasks in this study (Table 1). These colors consisted of 12 colors of SAKURA MAT WATER COLORS 12colors (Sakura Color, Inc.) and 3 colors, pink, purplish-red, and purple-blue, which were created by mixing the colors. The pink color was used because it was reported in previous studies that girls frequently preferred it (Sakai, et.al.,2005). Moreover, it is indicated by the previous study that young children knew the purple color well and preferred it (Imada, 1926; Shimada,2005; Ohashi,2007). Shimada (2005) reported that infants applied various names to the light purple used in her study. This indicates that young children could recognize colors similar to purple color with high affinity using various different words. From the result of such previous researches, it was decided to add purplish red and purple-blue which were similar to purple as alternative materials to verify a spread of recognition of the color in young children.

Table 1 Colors used in pre and post tasks

Number	Color name	Product name	Color information			
			Cyan	Magenta	Yellow	Key tone
1	Shiro	White 50	0	0	0	0
2	Lemon	Lemon Yellow 2	7	2	72	0
3	Kiiro	Yellow 3	7	7	78	0
4	Oudoiro	Yellow Ochre 15	33	44	78	0
5	Chairo	Brown 12	42	74	76	3
6	Shuiro	Vermilion 18	2	87	75	0
7	Aka	Red 19	17	91	78	0
8	Ao	Cobalt Blue 36	80	57	0	0
9	Aiuro	Prussian Blue 43	97	95	46	14
10	Kimidori	Yellow Green 27	54	0	80	0
11	Midori	Green 29	80	38	81	1
12	Kuro	Black 49	80	72	69	38
13	Momoiro	—	4	63	6	0
14	Akamurasaki	—	61	89	0	0
15	Aomurasaki	—	83	90	0	0

3.2.2 Paint play activity

We used paints of seven colors such as “kiiro” (#3 Yellow), “chairo” (#12 Brown), “aka” (#19 Red), “midori” (#29 Green), “ao” (#36 Cobalt blue), “shiro” (#50 White), “murasaki” (#24 Purple) in the Poster Color-Junior (Sakura Color, Inc.). Paints were mixed so that an undiluted solution and water might become a rate of 1:2, and five bottles of seven colors, each of which was a 500 ml plastic bottle, were prepared. The color name was written by Japanese on the white tape and it was stuck on the flank of the plastic bottle. In addition, 30 paintbrushes (length 27.8 cm, head 3.3 cm) and 10 consecutive brushes that can connect 3 to 4 paintbrushes and draw a lot of lines at once were used. And, 30 pudding cups and 20 empty containers of tofu were used for color mixture, 30 sheets of pulp paper (98 cm x 68 cm) were prepared for painting

3.3 Procedure

In the pre-task, the first author confronted with a child who was sitting in front of a desk in the educational material room adjacent to the nursery room, and she asked “What kind of color do you like?” without showing a colored card (the free utterance task). After that, she presented the child 15 colored sample cards one by one in the order shown in Table 1 and asked “What color is this?” (the naming task). The sample board with 15 colors was shown at the end, and she asked “Which of these colors do you like? You can choose as many as you want.” (the selection task). The participants carried out tasks indoors using sunlight and fluorescent lights in combination. After that, the following paint play activity was carried out, and the post-task having contents similar to the pre-task was carried out.

3.4 Ethical consideration

Since the targeted kindergarten of this research is the attached kindergarten of the research institute, their parents have agreed to use information on activities of the children and activities made by the children on sufficient protection of personal information.

4 PAINT PLAY ACTIVITY

4.1 Environmental configuration

Paint section

We put four tables of 90 cm×60 cm in the courtyard of the kindergarten so that children can use them as a workbench to mix paints. Paints, paintbrush, and the container for mixing paints were placed on the workbench.

A tree hut

In the courtyard, a tree hut of 190 cm in width, 194 cm in depth and 240 cm in height was placed and it was not colored yet.

White monument

There was also a conical monument of diameter 300cm and height 170cm in the garden. The bowels of the monument were a hollow, and there was an entrance where children can enter in a side.

Paper section

We put pulp paper on a blue sheet in a corner of the courtyard for painting.

4.2 The contents of activity

In paint play activity, five university faculty members, including the first author, participated as the participant observers. Since the kindergarten had set an educational objective as “Raising children to think and act,” neither the kindergarten teachers nor the university faculty members issued directions about mixing paints, or coloring, but supported the children's voluntary activities. The first author took a video shoot and took notes so as not to interfere with the paint play activity.

The homeroom teacher said to the children gathering in the courtyard, “Since it is getting cold, let's color the tree hut and the monument and dress them.” And she explained to the children that they could freely make colors using the paint prepared on the table and paint on white monument, tree huts, or pulp paper. During the activity, kindergarten teachers and university faculty members said to the children “please make your favorite color” and urged them to mix colors. When a child asked how to mix paint, they asked the child “what should you do?” They had never taught the child how to mix paints. After confirming that the children completed the color mixing, the kindergarten teachers and the university faculty members said “It's done, isn't it?” “It is a good color.” The children who participated in the activity focused on color mixing and coloring for about 50 minutes, then they moved to other play gradually. The kindergarten teacher did not give directions of the end of the activity, and she allowed children to begin other play by their will.

4.3 Children's behavior

4.3.1 About mixing colors

Each child name described in this paper is pseudonym. At the paint corner, the children poured the paint carefully into the container of pudding or tofu and mixed the paint. A child explained to the teacher “This color looks like the color made by Ryohei. But these two are a little bit different. Look carefully.” A university faculty member told a child who made a color like emerald green that it was a difficult color of making, she was floating the expression which seemed to be glad. Because it was likely to be brown when multiple colors are mixed, children often made brown without intending. At such time, the children were painting the hut or the monument with the color brown while saying “It looks like chocolate.” “It looks like mud.” In this way, the children mixed carefully and enjoyed the painting activity.

About coloring

Several children brought the beer crate, rode on it, and had painted with an earnest facial expression for the high place of the tree hut. Several other children had painted white monument little by little with the paintbrush. After a while, they climbed on tire propped against the monuments, hung down paints from the high place of the monument, and lengthened the paints by hand. A certain child put an acorn into the container with paint. Then, she took out the acorn from it, rolled on pulp paper, and drawn various lines. Another child drew lines like a rainbow on the pulp paper using a continuous brush. In this way, the children voluntarily devised the place where to paint the color and the way how to paint the color.

5 RESULTS

5.1 Change of color recognition

Table 2 shows the mean and standard deviation of color recognition score in naming task before and after the paint play activities. For the 12 colors which were shown in Table 3, the correct answer was counted when a product name was answered. In this research, we used 15 color paints as materials, three of which are colors created originally in this research and have no product name. A statistically significant tendency was found when we carried out a t-test corresponding to the scores before and after paint play activities ($t(33)=1.99, p<.10$).

Table 3 shows the number which the participant children answered correctly in the naming task before and after the paint play activity for each color. Before and after the paint play activity, the percentage of correct answers was no less than 85% about white, yellow, and black, and there were few children who responded the right answer in terms of "lemon (lemon yellow)", "oudoiro (yellow ochre)", "shuiro (vermilion)", and "aiiro (prussian blue)". Regarding the brown color, there were 12 children who did not show the correct answer before the activity but showed the correct one after the activity. On the other hand, the number of the children who showed opposite direction was 2. A significant difference was found in the deviation of the number when McNemar official approval was performed (two-sided test: $p=.016$).

Among the children who were not judged to have answered correctly in the naming task, there were children who explained a color using the modifier which means the shade of a color, such as "deep blue" "light red" "reddish brown." The number of the child who were doing such naming after activity without doing such naming before activity was 6, and the reverse number was 2. The significant difference was not found in the deviation of the number although McNemar official approval was performed (two-sided test: $p=.289$).

Table 2 Color recognition score (Naming task)

	average	SD
Before activity	5,44	1,74
After activity	5,91	1,53

Table 3 The number of correct answer children of the color name (%)

Number	Color name	Before activity		After activity	
1	Shiro	30	(88.24)	33	(97.06)
2	Lemon	0	(0)	0	(0)
3	Kiuro	29	(85.29)	30	(88.24)
4	Oudoiro	1	(2.94)	0	(0)
5	Chairo	14	(41.18)	24	(70.59)
6	Shuiro	0	(0)	0	(0)
7	Aka	22	(64.71)	23	(67.65)
8	Ao	27	(79.41)	28	(82.35)
9	Aiiro	0	(0)	0	(0)
10	Kimidori	10	(29.41)	11	(32.35)
11	Midori	22	(64.71)	20	(58.52)
12	Kuro	31	(91.18)	32	(94.12)

5.2 Change of color preference

5.2.1 Free utterance task

Table 4 shows the mean and standard deviation of the number of favorite colors in the free utterance task before and after paint play activity. The significant difference was found in the number before and after the activity when t-test with correspondence was performed ($t(33) = 5.64, p < .01$).

Table 5 shows the number of children who answered that they liked each color in a free utterance task. Prior to paint play activities, most of boys liked red, yellow and blue, and most of girls liked pink, yellow, and light blue. Whereas, many of boys liked red, blue, light blue, yellow, white, and green after the activity, and many of girls liked pink, yellow, light blue, blue and red.

Table 4 The number of favorite colors (free utterance task)

	average	SD
Before activity	2.00	1.02
After activity	4.21	2.42

Table 5 the number of children who liked each color (free utterance task)

Color name	Before activity			After activity		
	Whole	Boys	Girls	Whole	Boys	Girls
Kiirō	13	(7)	(6)	17	(9)	(8)
Aka	12	(10)	(2)	20	(15)	(5)
Mizuiro	10	(5)	(5)	16	(10)	(6)
Ao	9	(7)	(2)	21	(15)	(6)
Pink	9	(0)	(9)	12	(4)	(8)
Kuro	4	(4)	(0)	3	(3)	(0)
Murasaki	3	(2)	(1)	7	(4)	(3)
Shiro	3	(2)	(1)	10	(7)	(3)
Orange	3	(2)	(1)	6	(4)	(2)
Midori	2	(2)	(0)	8	(7)	(1)
Gin	0	(0)	(0)	4	(2)	(2)
Kimidori	0	(0)	(0)	3	(1)	(2)
Chairo	0	(0)	(0)	5	(4)	(1)
Others	0	(0)	(0)	10	(6)	(4)

5.2.2 Selection task

Table 6 shows the mean and standard deviation of the number of favorite colors in the selection task before and after paint play activity. A significant difference was found in the number of response before and after the activity when t-test with correspondence was performed ($t(33)=6.17, p<.01$).

Table 7 shows the number of children who answered that they liked each color in the selection task. Prior to paint play activities, more than 30% of

boys responded as they liked “ao (cobalt blue)”, “shuiro (vermilion)”, “lemon (lemon yellow)”, “kuro (black)”, and more than 30% of girls responded as they liked “momoiro (pink)”, “ao”, “lemon”. Whereas, more than 30% of boys responded as they liked all the colors used after that activity, and more than 30% of girls responded as they liked “momoiro”, “ao”, akamurasaki (purplish-red)”, “shiro (white)”, “kimidori (yellow green)”, “lemon”, “kiirō (yellow)”, “shuiro”, “aiiro(prussian blue)”, “kuro”, “aka (red)”, and “aomurasaki(purple-blue)”.

Table 6 The number of favorite colors(selection task)

	average	SD
Before activity	3.32	2.56
After activity	7.74	4.58

Table 7 The number of children who liked each color (selection task)

Number	Color name	Before activity			After activity		
		Whole	(Boys)	(Girls)	Whole	(Boys)	(Girls)
1	Shiro	6	(5)	(1)	21	(14)	(7)
2	Lemon	11	(7)	(4)	20	(15)	(5)
3	Kiio	5	(3)	(2)	12	(7)	(5)
4	Oudoiro	1	(1)	(0)	14	(11)	(3)
5	Chairo	2	(2)	(0)	15	(12)	(3)
6	Shuiro	12	(10)	(2)	19	(14)	(5)
7	Aka	5	(3)	(2)	17	(13)	(4)
8	Ao	18	(11)	(7)	28	(18)	(10)
9	Aiio	4	(4)	(0)	16	(11)	(5)
10	Kimidori	8	(5)	(3)	19	(12)	(7)
11	Midori	5	(5)	(0)	12	(9)	(3)
12	Kuro	7	(7)	(0)	17	(12)	(5)
13	Momoiro	12	(3)	(9)	17	(7)	(10)
14	Akamurasaki	9	(6)	(3)	19	(11)	(8)
15	Aomurasaki	5	(5)	(0)	17	(13)	(4)

6 DISCUSSION

The first purpose of this study was to examine the influence which children's paints play activities focusing on color-mixing experience have on enriching the color recognition of children. In the naming task, a statistically significant trend was found in the difference of the color recognition scores between before and after the paint play activity, indicating that this activity is likely to have a positive effect on enriching the color recognition in young children. Regarding naming task in terms of white, yellow and black, the percentage of correct answer was 85% or more in both before and after paint play activities. It is consistent with previous studies showing that these were highly-friendly colors for young children (Matsuoka, 1961; Matsumura & Nakata, 1991; Shimada, 2005). Or it may be said that these names of colors are often used verbally or nonverbally in daily life. On the other hand, children who answered the name of lemon, ocher, vermilion, indigo

blue correctly were few. This result suggests that these colors were lower-friendly or it might be hard to label these names for young children.

In this study, it became clear that the paint play activity has a positive influence on the recognition about brown. This is because there was a significant difference in the recognition of brown between before and after paint play activities. This result will be explained by the fact that when multiple colors are mixed, children often made brown without intending. In this way, the experience of touching brown paint has repeatedly affected to increase the color recognition of children for brown. It suggests that the frequent experience of such changing of color might stimulate children to the useful recognition of color.

Although previous studies have shown that the color recognition of infants is high with regard to red (Matsuoka, 1961; Matsumura & Nakata, 1991), the correct answer rate for young children

with regard to red color was about 60% in this study. This comparatively low rate may be explained by the fact that when the vermillion card was presented prior to the red card, many children answered incorrectly as "red." And then, when the red card was presented immediately after that, children got a tendency to make the different answer from "red" even though "red" was the correct answer. Therefore, the number of children who answered correctly might decrease. Although the correct answer rate of blue was about 80%, blue was selected as the most favorite color by the children in the color preference selection task. The reason for such discrepancy is that many children named "mizuiro", meaning light blue, against the blue used in this research. Regarding yellow-green color, the correct answer rate was about 30% both before and after paint play activity, and the correct answer rate for green was about 60%. Green and yellow-green would be difficult colors to recognize standardized color names for young children correctly. These results suggest that there is some issue of difficulty of suitable labeling in early child education.

The second purpose of this research was to examine the influence of color mixing experience through paint play activity on the color preference in young children. Since the number of favorite color of the young children increased significantly after the paint play activity in both the free utterance task and the selection task, it will be insisted that the paint play activity in this research has a positive influence on the spread of the color preference in young children.

In selection task after paint play activity, over 30% of boys said that they liked all 15 colors and over 30% of girls said that they liked 12 colors out of 15 colors used in this research. Thus, it is interesting to see that the color which is the target of attention in young children increased greatly. A girl, as an example, taught a researcher that although there were only

three favorite colors when she was asked before paint play activity, she taught him there were eleven colors when she was asked same question after the activity. She also said that "my favorite colors has increased." This episode clearly shows that the paint play activity in this research had affirmative influence on the spread of the children's color preference.

CONCLUSIONS

The background of the evidence that the paint play activity positively affects on color recognition and color preference in young children might be in a childcare environment that guarantees the voluntary of young children. In the paints play activity in this research, young children chose paints freely, poured in container carefully, and poured out, mixed or compared another color with other children's paints. They showed the teachers the paints mixed and made by themselves, and received their recognition. And they devoted to mix colors, taught other children how to mix paints, or were being taught from the other children. The children made dress and made hand and foot from full of paints, and for about 50 minutes they spent times tackling paint play activity until they were satisfied. Such experience might raise the ability of the color recognition in young children and promote a spread of color preference.

It is important for children to raise awareness of various colors and to use the colors effectively in their daily life through early childhood education. The present research suggests that children should be raised in an environment where they can play actively for everything that exists in the world surrounding them and can experience to have rich sensibility. The future research is to expand the age group of the target children and to examine what kind of child care environment affects color recognition and color taste in young children positively in each developmental stage.

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