



## **‘Sheep color, iron color, my room's color..’ How do 48-84 months-old children name and derivative colors?**

Aysel Ferah Özcan<sup>1</sup>

Hilal İlknur Tunçeli<sup>2</sup>

Eslem Gözde Şenöz<sup>3</sup>

Journal for Educators, Teachers and Trainers, Vol. 13 (5)

<https://jett.labosfor.com/>

Date of reception: 24 Aug 2022

Date of revision: 16 Oct 2022

Date of acceptance: 18 Oct 2022

**Aysel Ferah Özcan , Hilal İlknur Tunçeli, Eslem Gözde Şenöz (2022). ‘Sheep color, iron color, my room's color..’ How do 48-84 months-old children name and derivative colors? Journal for Educators, Teachers and Trainers, Vol. 13(5). 442-451.**

---

<sup>1,2</sup>Sakarya University, Faculty of Education,

<sup>3</sup>Research Assistant, Sakarya University, Faculty of Education,



## **‘Sheep color, iron color, my room's color..’ How do 48-84 months-old children name and derivative colors?**

Aysel Ferah Özcan<sup>1</sup>, Hilal İlknur Tunçeli<sup>2</sup>, Eslem Gözde Şenöz<sup>3</sup>

<sup>1,2</sup>Sakarya University, Faculty of Education,

<sup>3</sup>Research Assistant, Sakarya University, Faculty of Education,

\*Corresponding author

Email: aferah@sakarya.edu.tr<sup>1</sup>, htunceli@sakarya.edu.tr<sup>2</sup>, eslemfide@sakarya.edu.tr<sup>3</sup>

### **ABSTRACT**

This study aims to investigate children's color naming levels and color name derivation tendencies. Also, this study investigated whether the color naming levels of the children differed according to gender and age. The study group consists of 431 preschool and first-grade children (48–84-month-old). This research was carried out as a descriptive survey study. The data were collected through a questionnaire form prepared by the researchers. The Chi-Square test technique and document analyses were used to analyze the data. The results show that the most recognized colors by children are red, yellow, and blue, the primary colors, respectively. On the other hand, children have difficulty naming colors: lilac, brown, navy blue, and gray. According to the results, primary and warm colors were named more accurately than the other hues. Moreover, children had difficulties naming the lightness and darkness levels of the colors. Name derivations for colors by 48-84-month-old children were collected under ten different themes. According to the results, the prominent themes in children's derivation of color names are light (e.g. light yellow), dark (e.g., dark green), closed (e.g., closed blue), reinforcers and quantifiers (e.g., very closed green), analogy to object and being, made-up color names, vibrant color names uncertain color names and color names in the literature. Document analyses indicates that children's main difficulty with colors is nomenclature.

**Keywords:** early childhood, color, color perception, color naming, derivation.

### **INTRODUCTION**

Colors are one of the most important conceptual development areas in forming children's ideas of the world. Colors are defined as three-dimensional depending on the tone, saturation, and brightness qualities (Carlson, 2013). Colors are perceived as more apparent as their saturation increases, lighter as their saturation decreases and brightness increases, and closer to black as their brightness decreases. Thus, the perception of colors depends on the brightness (intensity), saturation (vividness), and wavelength levels of light. Color perception varies according to natural light, artificial light, textures, and materials surrounding and emphasizing color (Read & Upington, 2009). Color constancy is defined as color constancy when the object's color remains unchanged despite variable lighting conditions (Bee & Boyd, 2009). Color perception can also be influenced by information in individuals' experiences and memories. It is quite interesting that people not only have an enormous color capacity (about 7 million colors) but can also distinguish these colors from each other (Collective, 2015).

### **Development of Perception and Naming of Colors**

Colors are associated with both the field of vision and cognition. There is a permanent imprint of colors in human memory. It is seen that even though there are individual differences, the development of color perception preference (color invariance, color classification) in infants increases depending on the month and that the colors used in the immediate environment affect infants and children (Dannemiller & Hanko, 1987; Franklin et al., 2005; Okamura et al., 2007; Wong & Hines, 2015; Zemach & Teller 2007). In a study investigating the environmental preferences of preschool children in size, shape, color, complexity, texture, and lighting, it was found that as young children's object recognition skills increase, they rely more on form, color, and texture than movement. Furthermore, it has been observed that 3-5-year-old boys prefer warm and dramatic colors, while girls prefer cool mid-tones (Cohen & Trostle, 1988).

Studies on the differentiation and naming of colors have shown that color perception and differentiation in children develop at an early age (Bornstein, 1975), and the naming of colors develops later (Bornstein, 1985). Some researchers found that children can name basic color terms without errors around five, which is

accelerated by school education (Bornstein, 1985). Also, there are differences between children regarding color term acquisition (Kowalski & Zimiles, 2006), while others found that most children master color names around seven (Raskin et al., 1983). Meibauer (2015) considers that there is an interaction between color perception and color decency.

According to Miller (2008), children think that the name of an object is as specific as its color and shape. However, due to neurological maturation and integration difficulties (Bornstein, 1985), their ability to name a particular color has not been fully developed, even though they randomly answer the question 'What color is this,' which is an indicator of the perceptual dimension, with the correct color name (Kummerling- Meibauer, 2015). Children must learn to match color categories and terms and define the boundaries between color categories (Wagner et al., 2013). Young children tend to categorize the color independently of language from infancy, and there are commonalities between infant color categories and language color categories (Maule & Franklin, 2019). Why color naming is difficult for children is not entirely known. However, one reason may be that naming millions of colors requires dividing into more limited categories (Rogers et al., 2020) because different color terms are used for different regions of the color space. However, these color terms used are limited. Although color terms differ numerically in different languages, the boundaries of color categories are also consistent across languages (Lindsey & Brown, 2009). There has been one study found in the literature focused on the relationship between color terms and object names in different languages (Griber et al., 2018). Differences in color terms in languages (e.g., in Greek, unlike English, blue is also categorized as light and dark) and relationships with neural processing models have also been investigated (Thierry et al., 2009). It is known that language affects perception. Recent studies show that color terms negatively affect awareness of colored stimuli and color-related objects and provide new evidence for language-perception interaction in the brain (Forder et al., 2016).

Pitchford and Mullen (2005) found that perception does not directly shape young children's acquisition of the term color, children prefer brown and gray significantly less than primary colors, and these color terms appear substantially less in children's speech. Therefore, they suggested that color preference may be linked to linguistic input and developing color cognition. In addition, they reported that children confuse colors that were adjacent in the color spectrum (for example, blue and purple). When one of the adjacent colors was placed next to the color at the farther point, it was more likely to be named more accurately by the child. On the other hand, Rogers et al. (2020) determined in a recent study that there are positive relationships between color constancy and knowledge of color terminology. The results point to a strong link between the development of color constancy, language learning, perceptual processing, and cognitive development. While progress in color constancy can support color term learning, progress in learning color terms can also affect color constancy development. It is necessary to distinguish color name variability and color variability between and within color categories to name object colors correctly.

### **Current Study**

Although there are studies in the literature about children's color naming (Baniani, 2022; Mohebbi, 2014; Xu et al., 2022), there are limited number of studies involving a large group of participants on the skills of naming 24 colors so far. In these studies, children's limited color naming skills were investigated. In our current study, a large group of participants discussed children's color naming and color-naming derivation skills extensively. Thus, more detailed data were obtained regarding the ability of 48-84-month-old children to name colors and derive color names. According to studies, young children who can group colors well with color terms are also better at color constancy (Witzel et al., 2013). Therefore, with the data obtained from the research, it is possible to make inferences about the development of color stability in children, albeit indirectly. In addition, the opinions that the development of color naming lasts until a more advanced age (Kummerling-Meibauer, 2015) were also examined in detail with the current research on children aged 48-84 months. It is thought that the study will contribute to the literature for the reasons described above. This study aims to determine the color naming levels of children aged 48-84 months, whether these levels are related to gender and age variables, and ways to derive a color name. The following questions were answered in the research.

1. What is the status of children's color naming?
2. Is there a significant difference in the color naming levels of children aged 48-84 months according to gender and age?
3. What kind of color names do 48-84-month-old children derive?

### **Method**

This research is a descriptive survey study. In survey studies, data is collected to identify certain characteristics of a group (Creswell, 2012). In this study color naming levels of children aged 48-84 months were tried to be depicted as they are in the universe.

## Participants

Participants of the research are the 48–84-month-old children in the kindergartens and first grades of the public primary schools affiliated to the Ministry of National Education in the Hendek district of Sakarya province in Turkey in the 2021-2022 academic year. Children in the kindergarten and first grades of four primary schools are determined by convenience sampling. In this study, a total of 431 participants who received parental consent for sampling and voluntary participation were taken. 50.53% of the participants are boys (213), and 50.47% are girls (217). The number of survey forms containing invalid data is 1. The number of participants remaining after the invalid survey forms were removed is 430. Furthermore, the 58.5% of the participants are 72-84 months (n=252), 10.2% are 66-71 months (n=44), 16.9% are 60-65 months (n=73). 14.39% of them were in the age range of 48-59 months (n=62).

## Data Collection Tools

Data were collected with a questionnaire and demographic information form. During the questionnaire preparation, the literature was scanned, and categories related to color were determined first. There are dozens of words used for colors in today's societies. Before deciding on the number and shades of colors to be used in the study 1, interviews were conducted with field experts and teachers to get their ideas about the number of colors. Expert opinion was sought for the content validity of the prepared questionnaires. Opinions of two field experts, two art education experts, and two measurement and evaluation experts were taken for the color scale to be used in the study.

As a result of these interviews, it was determined that 24 crayons were used in painting lessons in schools. A scale containing 24 colors was prepared for the study. The color equivalents of the prepared scale in the Munsell Color Catalog (Reed, 2021) were determined (light yellow (7.5 y9/6), yellow (10y9/12), orange 2.5yr6/14, light orange 7.5yr7/12, light pink 10p8/8, pink 7.5rp6 /16, light purple 2.5rp5/14, purple 10p4/18, light red 7.5r5/18, red, light brown 10yr5/8, brown 2.5yr2/8, dark brown 7.5yr1/2, very dark green 2.5gy1/2, kgreen7.5gy2/6, light green 10gy9/12, green 10gy6/12, light blue 10b8/4, blue 2.5pb7/6, dark blue 5pb2/6, dark blue 5pb1/4, gray 10y3/2). Regarding this scale, the colors in the questionnaire were prepared as 3x5 cards, from white, which is a neutral color, to black, which is also a neutral color, to include different tones.

## Procedure

The researchers administered the Ishihara test for color blindness to children, and children with color blindness were not included in the study. The researchers conducted the applications one-on-one with the children who received voluntary parental consent. The applications were made in quiet environments shown by school administrations. The data were collected in a suitable environment, and the reliability of the study was tried to be increased. Individual interviews with the participants lasted an average of 7 minutes. The children were asked the name of the color. Using different tonal values of some colors has been tried to obtain information about the development of young children's ability to name colors. Furthermore, color names other than the primary ones were analyzed through the article, and themes for color derivation were determined.

## Analysis of the Data

In this study, since it was wanted to determine whether the children aged 48-84 months showed a significant difference according to their variables such as color naming levels and gender and age, the data were examined using the Chi-Square (Chi-Square Test  $\chi^2$ ) technique. The analysis of the data was carried out with the SPSS 23.0 program. Also, the color names produced by the children, apart from the primary color name, were classified. It has been determined that children use different concepts for colors. It was determined that some of the children named colors by analogy with objects and assets, going beyond the familiar names of colors. The color names produced by the children other than the primary color name were determined, and their frequencies were extracted. Then, these colors were thematized according to derivation and presented in a table. The study's accuracy was checked by comparing the themes that emerged by making the coding separately by two researchers. Inter-practitioner reliability was calculated as .90. According to Miles and Huberman (1994), the level of reliability should be 70% and above. When the reliability value (88%) obtained from the study was compared with the critical value (70%), the results obtained from this study are considered reliable (Creswell, 2012).

## RESULTS

The findings obtained by the Cross Table analysis regarding the naming levels of 24 colors according to the gender variable of the children are presented in Table 1.

**Table 1. The Levels Recognition and Conceptualization Of 24 Colors According to the Gender of the Participants**

Color	Total %	Girls %	Boys %	Color	Total %	Girls %	Boys %
White	74.5	75.8	73.2	Light Green	94.9	94.9	94.8
Yellow	74	70.5	77.5	Light Red	88.1	84.5	91.7
Orange	80.7	77.1	83.5	Light Blue	94.9	95.4	94.4
Pink	90.5	90.5	86.4	Light Pink	36	41.5	30.5
Red	92.5	91.5	93.5	Light Brown	0.9	0.5	1.4
Lilac	0.5	0	0.9	Dark Green	59.5	59.9	58.2
Purple	80.5	77.9	83.1	Very Dark Green	56.1	55.3	54.9
Green	90.5	89.9	91.1	Dark Blue	68.3	65.7	70.9
Blue	87.9	87.6	88.3	Navy Blue	13.5	13.8	13.1
Brown	14.4	14.3	14.6	Dark Brown	85.4	88.9	81.7
Light Yellow	82.7	83.3	82.2	Grey	44.2	47.9	40.4
Light Orange	44.4	51.6	37.1	Black	92.6	94.9	90.1

Also it was found that the difference between the gender and levels of naming white, light yellow, yellow, orange, light red, purple, brown, light green, green, dark green, very dark green, light blue, blue, dark blue, navy blue, gray were not significant. But the difference between gender and the levels of naming the light orange ( $\chi^2=9.184$  sd=1 p=.002), light pink ( $\chi^2=5.599$  sd=1 p=.018), pink ( $\chi^2=8$  sd=1 p=.004), light red ( $\chi^2=5.328$  sd=1 p=.021), dark brown ( $\chi^2=4.518$  sd=1 p=.034), black ( $\chi^2=3.581$  sd=1 p=.043) were significant. Whether the color naming levels of 48-84-month-old children differ significantly according to age was examined with a cross table. The findings are presented in Table 2.

**Table 2: Levels of Recognition and Conceptualization of Colors According to the Age of the Participants**

Color	Total %	48-71 months %	72-84 months %	Color	Total %	48-71 months %	72-84 months %
White	74.5	60.9	84.4	Light Green	94.9	92.7	96.4
Yellow	74	67	79	Light Red	88.1	88.3	88.1
Orange	80.7	77	83.3	Light Blue	94.9	95	94.8
Pink	90.5	91.1	90	Light Pink	36	33.5	37.7
Red	92.5	86.5	96.8	Light Brown	0.9	0	1.6
Lilac	0.5	0.6	0.4	Dark Green	59.5	57.5	61.1
Purple	80.5	66.5	90.5	Very Dark Green	56.1	49.2	59.1
Green	90.5	89.9	90.9	Dark Blue	68.3	73.6	64.7
Blue	87.9	86	89.3	Navy Blue	13.5	12.8	14.3
Brown	14.4	11.2	16.7	Dark Brown	85.4	89.4	82.5
Light Yellow	82.7	86	80.4	Grey	44.2	44.7	43.7
Light Orange	44.4	48.8	43.3	Black	92.6	94.4	91.3

Also it was found that the difference between age and the levels of naming light yellow, orange, light orange, light pink, light red, red, lilac, brown, light green, green, dark green, light blue, blue, dark blue, gray, black were not significant. But the difference between the age and the levels of correct naming of white ( $\chi^2=30.411$  sd=1 p=.000), yellow ( $\chi^2=7.744$  sd=1 p=.005), purple ( $\chi^2=38.405$  sd=1 p=.000), dark brown ( $\chi^2=3.930$  sd=1 p=.04), dark green ( $\chi^2=4.199$  sd=1 p=.04), dark blue ( $\chi^2=3.832$  sd=1 p=.05) were significant.

While naming colors, the color names that 48-84-month-old children derive from other than the primary colors were classified, and the derivation ways were determined. The obtained data are presented in Table 3.



Table 3:Color Derivation Ways

Ways of derivation	Name of Color	f	Ways of derivation	Name of Color	f
Colors created with the word closed***	Closed orange	23	Colors created with the word light	Light green	174
	Closed yellow	46		Light blue	220
	Closed blue	143		Light red	29
	Closed green	141		Light pink	140
	Closed purple	3		Light yellow	90
	Closed brown	12		Light brown	18
	Closed black	7		Light black	6
	Closed pink	29		Light orange	6
Colors created with the word dark***			Reinforcers, other quantifiers	Light purple	19
	Dark orange	20		Azure	2
	Dark yellow	74		A little blue	1
	Dark blue	266		A little brown	1
	Dark green	257		A little green	1
	Dark red	73		Darkest navy blue	1
	Dark navy blue	10		Darkest green	2
	Dark purple	10		Darker green	5
	Dark black	3		A little bit of dark color	1
	Dark pink	10		Darker blue	5
	Dark nude	14		Darkest blue	4
Analogy to object and being			Analogy to object and being	Very light blue	2
	Nude	458		Darker red	1
	Face color	12		Very darker purple	2
	Water green	11		Sky color	2
	Water blue	23		Nature green	1
	Rabbit color	1		Eye color	1
	Baby blue	2		Mud color	2
	Dark pig color	2		Pistachio green	2
	Sheep color	3		Leaf color	1
	Sea blue	5		Powder pink	1
	Grass green	2		Iron color	2
	Emerald	3		My room's color	1
	Poop color	2		Powder color	1
	Straw green	2		Tree color	2
Dress color	1	Military green	4		
Mustard color	9	Flower color	2		
Orange	4	Gold color	7		
Made-up color names created using two colors.			Made up colors	Cream color	29
	Purple pink	1		Strawberry color	2
	Navy blue green	1		Felt tip pen black	2
	Gray pink	1	Felt tip pen blue	1	
	Burgundy blue	1	Transparent	1	
Burgundy green	1	Vibrant color names	Disgusting green	1	
Uncertain color names	Different color		8	Color names in the literature	Turquoise
	Another green/pink	5	Burgundy		1
	Mix color	9			

\*\*\*The word "light", is homonymous with the word "open" in Turkish. For this reason, some children add the word "closed", which is the opposite of open, before the colors when describing "dark" colors.

Name derivations for colors by 48-84-month-old children were collected under ten different themes phrases formed with the words closed, light, dark; reinforcers and quantifiers; analogy to object and being made-up color names created using two colors; made up colors vibrant color; uncertain color and color names in the literature and presented in Table 3. When children do not know the exact name of the color, they make up words using objects such as sun, skin, and flower for orange; or using shades of yellow such as light yellow, mustard

color, mustard yellow, dark yellow, thick yellow, thick golden yellow, slightly orangy yellow. Instead of light pink, they named it by giving analogies such as powder, pig, powder, dress color, and incorrect color names such as thick yellow, powdery pink, and slightly locked pink. It has been observed that they use fruit color in the form of strawberry color instead of red; colors from the yellow and red family such as orange, brown, fuchsia, burgundy, another pink; quantity markers such as full, very, dark, thick, locked red. It can be said that the color names that children say instead of red are the color names in the red color family. Quantity markers such as top, off, dark, and light pink instead of lilac; color names such as purple, skin color, mixed color, pink powder, red; rose color, nail polish color such as similar object and entity names have been used. Instead of purple, they used the name pink and its shades, red color. Since purple is considered a shade of red, it can be understood that children's made-up colors are also made around red colors in the color spectrum.

Some of the children used object and entity names in green color pigment such as water, peanut, pure, sea, and grass green color instead of light green. Instead of green, it was seen that they conceptualized the names for shades of green such as light-dark-off, very, a little, another green by analogy with objects, beings, and colors such as algae, water, earth, gray, grass green. To describe green some children use quantifiers such as dark, off, light, a lot, a little, wide, more, thick green; or use words such as mixed green, different green and green; based on similarities to an object such as olive, soldier, silver, water, emerald, straw, wood, felt, grass, leaf, nature, tree; or use phrases they form with the word "color" like leaf color, horse color, moss color, mint color, the color of my room. They use the wrong color names such as dark blue green, black, very black, blue, dark brown, brown tones, or with phrases such as disgusting green, poop color, mud that reveal their level of appreciation. Based on the words that children make up instead of dark green, it can be said that they perceive the dark shade of green correctly, but they have difficulties in naming it. In addition, it can be understood from the words that they say, like poop and disgusting, that the dark shade of green is a color that is not very liked by some of the children. Some of the children use the color very dark green with different words of quantity and analogy, such as the darkest, lightest, closed, dark, most, more, little, very, thick, and very green; with incorrect color names, such as yellow, black, brown. They draw similarities between the color and the objects, such as water, horse, leaves, dark grass, and emerald, and create words like the burgundy of green, the color of grass, green in nature, color of trees, dark mud, mud color, wood color. It is seen that they name the color with the phrases they have created in other words.

Some of the children used to tone and comparison words such as light, dark, off, and most blue instead of light blue; words containing objects and entities created with the word blue such as sea, water, ice, cloud, ocean, baby blue; words are containing objects and entities created with the word color such as sea, sky, watercolor, or a different color name belonging to the color blue such as turquoise. Some of the children will reinforce the tone and comparison words such as dark, light blue instead of blue, such as azure; they used the color name of a shade of blue, such as navy blue, or the accurate description they created by likening it to an object, such as a pool. Some children used to tone and compared words such as very blue, darker blue, darkest blue, more blue, other blue, bluest, medium blue, and a little blue instead of dark blue; phrases containing objects and entities such as dotted, sea, water blue. In addition, they have made up different color names or reinforcers for blue such as shades of blue, azure, blue blue, and navy blue. Instead of navy blue, children used words containing shades and ratings for blue, such as darkest, other darker, darker, slightly blue, maroon, felted, and light water blue, such as assets, objects, and colors.

Children's use of black, lilac, purple, brown, red, wall color, smoke color, light gray, iron color, ashen color, light gray, transparent, purple, silver color, and chalk color for gray is also an indication of the difficulties they face in naming gray. The use of concepts such as purple, brown, light black, dark green, green, white, green, dark green, emerald, yellow, closed black, blue, yellow, thick black, felt black, and jet black instead of black means that some children cannot name the color black. This is an example of how they try to define color.

## **DISCUSSION AND CONCLUSION**

A quarter of 48-84-month-olds misnamed one of the neutral colors, white. Again, black, which is a neutral color, is mostly named correctly by children. Especially young children misnamed the color white. The reason for this can be that white acquires a more polluted image due to the influence of ambient lighting. Color perception varies according to natural light, artificial light, textures, and materials that surround and emphasize color (Read & Upington, 2009). Thus, it can be said that the high level of false naming of white compared to black may also be caused by the lighting of the environment.

The second important result of the research is that red, yellow, and blue, the primary colors, are largely recognized by young children. It can be said that the primary colors are correctly recognized as red, blue, and yellow, respectively. This result is consistent with previous studies which similarly report that babies can distinguish primary colors and some secondary colors perceptually (Franklin & Davies, 2004). Among young children, primary colors are conceptualized earlier. Again, it can be said that the participants named the purple color obtained by mixing red and blue, the orange color obtained by mixing yellow and red, and the green color obtained by mixing yellow and blue with over 80% accuracy. It was understood that the participants named

green color more accurately than purple and orange colors. Depending on the findings it can be said that the colors that Turkish-speaking children name correctly at an early age are primary colors such as red, blue, yellow, and intermediate colors such as orange and green.

According to the third result of the study, the colors that young children have difficulty naming are light and dark tones of color. Although children correctly name colors such as red, pink, blue, and green, it seems to be more difficult for children to name the light and dark forms of these colors. This finding is interesting considering that being able to define colors as light-dark-darker is also related to the development of classification/ (sorting) skills. It can be said that children have difficulty classifying colors as they are young. However, Turkish-speaking children use the phrases nearly, most thick, most, slightly thick, and very thick instead of dark in proportion to their young age (48-59 months). This situation also reveals the developmental status of children in using some adjectives and adverbs in color naming. Some children distinguish the color's hue/tone value; however, it is challenging to say the correct color term that corresponds to this hue/tone value. This result indicates that children's main difficulty with colors is nomenclature.

In our research, it has been observed that some younger children also define all shades of color with the same concept by making excessive generalization. It is understood that these results obtained are also consistent with the data of developmental psychology, which reveal that children are more incompetent in comparing two things and tend to over-generalize. For example, while children name blue and green largely correctly, their success rate in naming the dark forms drops to 55-60%. Correct naming rates of children aged 48-71 months for dark blue and dark brown and light yellow and light orange are higher than those of 72-84 months old children. This result suggests that correctly naming the light or dark values of colors may be related to education and socio-cultural factors rather than age. It can be said that children who grow up in environments where language is rich and receive preschool education will name color terms more accurately than some older children. It has been seen that children express colors such as dark green and dark blue, which are specially described as cold colors, with words such as thick, locked, most, little, etc. The fact that young children use other adjectives or adverbs instead of dark can be interpreted as that although they have started to classify colors, they still have difficulties naming colors because children's correct naming of colors such as blue, green, red, and yellow in light tones is relatively high. Children's success in naming colors such as brown and lilac from light shades is low. Children confuse lilac with pink and purple, which might be due to closeness of these colors in the color spectrum (Pitchford & Mullen, 2005). It can also be said that the similarity and proximity of the colors have a confounding effect (memory effect). It is understood that children have difficulties matching color categories and name terms, especially in colors such as lilac and light brown.

It has also been determined that young children are quite novice in naming light orange and light brown, which should be characterized as light. As their age is young, children can either name shades of colors with different words or misuse adjectives for classification, such as light and dark, due to the pressure of the daily language used in their immediate environment. Especially with the pressure of everyday language, it may be thought that some of the children use the concept of coffee with milk more instead of light brown. It seems young children do not yet realize that the names of colors also change depending on the differences in tone.

The results of the study demonstrated that the colors children failed the most in naming were lilac, brown, navy blue, and gray, respectively. There was no difference in the naming of these colors according to age. The reason behind this finding might be due to the frequency and use of these color names in children's language and immediate environment. As LoBue and DeLoache (2011), in a study conducted with preschool children, stated that children prefer brown and gray colors less than orange, pink, and purple colors; these colors are used relatively less in conversations with children, so color preference may be related to linguistic input and color cognition. Thus, the results of this study support the idea that the success of naming these colors decreases due to linguistic input limitations and color cognition related to colors such as brown and gray in convergent development areas of children. In particular, it is necessary to determine whether the color lilac is expressed in different terms in social life. Some studies have shown that children's acquisition of color concepts is influenced by the mother's use of language (Andrick et al., 1986; LoBue & DeLoache, 2011) and cultural factors (Zollinger, 1988). As can be seen from these studies, the language used in the child's immediate environment can also shape language development and the acquisition of color names. It is also predictable that society-specific color terms will structure children's color cognition. There is also a question of confusing lilac with pink, navy blue with blue-black. It can be seen that young children have difficulty distinguishing and naming these colors. Older children were more successful in naming the colors white, yellow, purple, and very dark green, and results showed that correct naming of colors differed significantly according to age ( $p \leq .05$ ). In particular, it has been observed that yellow is the skin color, purple is pink, dark blue is brown, and green is either a direct color name or a name by analogy with an entity. It can be said that colors such as red, yellow, purple, blue, pink, and green are mostly named correctly by young children.

The reason behind the fact that children use the word "closed" instead of the word "dark" when deriving color names may be their inability to distinguish between the words dark and closed yet. As a result of learning the correct use of words in time, the word closed will be replaced by the word bold. When children are not able to



name the color correctly when deriving a color name, ambiguous words (e.g., another green), words for the similarity of an object and being (e.g., noun phrases formed with a color word such as eye color, lamb color, or sea color), fabricated color names (e.g., felt black), expressive words (e.g., nasty green), reinforcers, and quantifiers (e.g., azure, darkest blue, darker green). Especially in blue and green tone values, the rate of children using the word off instead of the dark is relatively high. Some children tend to term the colors light yellow and light brown as skin color. It can be said that children tend to use words that indicate the tonal values of the color, such as light-dark while deriving color names.

### Statements and Declarations

#### Conflict of interest

The authors have no relevant financial or non-financial interests to disclose.

#### Ethical Statement

Permit of the ethics committee was obtained by the university ethics committee by the decision dated 09.02.2022 with no. 04.

### REFERENCES

1. Andrick, G. R., & Tager-Flusberg, H. (1986). The acquisition of colour terms. *Journal of Child Language*, 13(1), 119-134.
2. Baniani, M. (2022). The association between colors, color preferences, and emotions among Japanese students: Japanese students: From elementary school to university. *Color Research & Application*, 47(4), 992-1004. <https://doi.org/10.1002/col.22774>
3. Bee, H. L., & Boyd, D. R. (2009). *Lifespan development*. Boston: A & B Pear.
4. Bornstein, M. H. (1975). Qualities of color vision in infancy. *Journal of Experimental Child Psychology*, 19(3), 401-419. [https://doi.org/10.1016/0022-0965\(75\)90070-3](https://doi.org/10.1016/0022-0965(75)90070-3)
5. Bornstein, M. H. (1985). On the development of color naming in young children: Data and theory. *Brain and Language*, 26(1), 72-93. [https://doi.org/10.1016/0093-934X\(85\)90029-X](https://doi.org/10.1016/0093-934X(85)90029-X)
6. Carlson, N. R. (2013). *Foundations of behavioral neuroscience*. (G. Tatlıcı, Trans). Nobel Publishing. (Original work published 2010).
7. Cohen, S., & Trostle, S. (1988). Choice and stability of young children's preferences for physical-environmental setting characteristics. *Perceptual and Motor Skills*, 66(1), 187-191.
8. Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Boston, MA: Pearson.
9. Dannemiller, J. L., & Hanko, S. A. (1987). A test of color constancy in 4-month-old human infants. *Journal of Experimental Child Psychology*, 44(2), 255-267. [https://doi.org/10.1016/0022-0965\(87\)90033-6](https://doi.org/10.1016/0022-0965(87)90033-6)
10. Forder, L., Taylor, O., Mankin, H., Scott, R. B., & Franklin, A. (2016). Colour terms affect detection of colour and colour-associated objects suppressed from visual awareness. *PLoS ONE*, 11(3),
11. Franklin, A., Pilling, M., & Davies, I. (2005). The nature of infant color categorization: Evidence from eye movements on a target detection task. *Journal of Experimental Child Psychology*, 91(3), 227-248. <https://doi.org/10.1016/j.jecp.2005.03.003>.
12. Franklin, A., & Davies, I. R. L. (2004). New Evidence for Infant Colour Categories. *British Journal of Developmental Psychology*, 22, 349-377. <http://dx.doi.org/10.1348/0261510041552738>.
13. Collective (2015). *Duyu ve Algı [Sense and Perception]*( Y. Dinç Trans). *Aklımın aklı psikoloji. [Mind of my mind psychology]* (eds. Mithat Durak-Emre Şenol Durak-Ufuk Kocatepe). Nobel Publishing.
14. Griber, Y. A., Mylonas, D., & Paramei, G. V. (2018). Objects as culture-specific referents of color terms in Russian. *Color Research & Application*, 43(6), 958-975.
15. Kay, P., Berlin, B., Maffi, L., Merrifield, W.R. & Cook, R. (2009). *The World Color Survey*. CSLI Publications, Stanford.
16. Kowalski, K., & Zimiles, H. (2006). The relation between children's conceptual functioning with color and color term acquisition. *Journal of Experimental Child Psychology*, 94(4), 301-321.
17. Kummerling-Meibauer, B., Meibauer, J., Nachtigäller, K., & Rohlfing, K.J. (2015). *Learning from picturebooks: Perspectives from child development and literacy studies*. (E. Uşşaklı, Trans.). Koç University Press (Original work published 2017).

18. Lindsey, D. T., & Brown, A. M. (2009). *World Color Survey color naming reveals universal motifs and their within-language diversity*. *Proceedings of the National Academy of Sciences*, 106(47), 19785-19790.
19. LoBue, V., & DeLoache, J. S. (2011). Pretty in pink: The early development of gender-stereotyped colour preferences. *British Journal of Developmental Psychology*, 29(3), 656-667. <https://doi.org/10.1111/j.2044-835X.2011.02027.x>
20. Maule, J., & Franklin, A. (2019). Color categorization in infants. *Current Opinion in Behavioral Sciences*, 30, 163-168.
21. Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded Sourcebook*. (2<sup>nd</sup> ed). Thousand Oaks, CA: Sage
22. Miller, P. H. (2008). *Theories of Developmental Psychology* (Z. Gültekin, Trans.). İmge Publishing. (Original work published 2002).
23. Mohebbi, M. (2014). Investigating the gender-based colour preference in children. *Procedia-Social and Behavioral Sciences*, 112, 827-831. <https://doi.org/10.1016/j.sbspro.2014.01.1238>
24. Okamura, H., Kanazawa, S., & Yamaguchi, M. K. (2007). Development of chromatic induction in infancy. *Infant and Child Development: An International Journal of Research and Practice*, 16(6), 629-648. <https://doi.org/10.1002/icd.530>
25. Pitchford, N. J., & Mullen, K. T. (2005). The role of perception, language, and preference in the developmental acquisition of basic color terms. *Journal of Experimental Child Psychology*, 90(4), 275-302. <https://doi.org/10.1016/j.jecp.2004.12.005>
26. Raskin, L. A., Maital, S., & Bornstein, M. H. (1983). Perceptual categorization of color: A life-span study. *Psychological Research*, 45(2), 135-145. <https://doi.org/10.1007/BF00308665>
27. Read, M. A., & Upington, D. (2009). Young children's color preferences in the interior environment. *Early Childhood Education Journal*, 36(6), 491-496. <https://doi.org/10.1007/s10643-009-0311-6>
28. Reed, R. (2021). *The New Munsell Student Color Set 6th Edition*. Fairchild Books, New York.
29. Rogers, M R, Witzel, C, Rhodes, P & Franklin, A (2020) Color constancy and color term knowledge are positively related during early childhood. *Journal of Experimental Child Psychology*, 196.
30. Thierry, G., Athanasopoulos, P., Wiggett, A., Dering, B., & Kuipers, J. R. (2009). *Unconscious effects of language-specific terminology on preattentive color perception*. *Proceedings of the National Academy of Sciences*, 106(11), 4567-4570.
31. Wagner, K., Dobkins, K., & Barner, D. (2013). Slow mapping: Color word learning as a gradual inductive process. *Cognition*, 127(3), 307-317.
32. Witzel, C., Sanchez-Walker, E., Franklin, A. (2013). The development of categorical colour constancy. *Perception*, 42 (ECP Abstract Supplement), 19.
33. Xu, W., Xu, H., & Guo, X. (2022). Modelling design of color graphics books using visual vocabulary based on children's color language preferences. *Computer Modeling in Engineering & Sciences*, 130(2), 1171-1192. <https://doi.org/10.32604/cmescs.2022.017824>
34. Zemach, I. K., & Teller, D. Y. (2007). Infant color vision: Infants' spontaneous color preferences are well behaved. *Vision Research*, 47(10), 1362-1367. <https://doi.org/10.1016/j.visres.2007.02.002>.
35. Zollinger H. (1988). Categorical color perception: influence of cultural factors on the differentiation of primary and derived basic color terms in color naming by Japanese children. *Vision research*, 28(12), 1379-1382. [https://doi.org/10.1016/0042-6989\(88\)90069-7](https://doi.org/10.1016/0042-6989(88)90069-7)