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# THE WORLD OF PLANTS IN CHILDREN'S DRAWINGS: COLOR PREFERENCES AND THE EFFECT OF AGE AND GENDER ON THESE PREFERENCES

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**Abstract.** *Plants is a neglected topic in biology education. Educational activities about plants are important in early terms because they are the base of both the science and the biology education. The purpose of this research is to understand opinions of the children by utilizing drawings and the colors they used. It is run by the phenomenological model point of view in qualitative research method. In the scope of the research, researchers worked with 80 children (40 girls, 40 boys). Data of the research consist of children's drawings. In this context, A4 sized papers and crayons have been distributed to children and they have been asked to make drawings of plants. At the end of the research, it was found that there was a total of 21 different elements and that these elements were drawn 237 times in the children's drawings. Moreover, no statistically significant dependence was particularly found between the elements of the sun, tree, flower, grass and rain, and age and gender. Similarly, while no significant correlation was found between the number of colors used in the drawings and age, a statistically significant correlation between the number of preferred colors and gender was found in favor of the girls. Furthermore, it was found that the children preferred light colors in their drawings. In light of the findings of the current research, it can be argued that science education given during the preschool period should be conducted by using methods, which are enjoyable and allow children to reflect the knowledge in their minds, for example, through drawings.*

**Key words:** *children's' drawing, plant world, biological knowledge, qualitative research, phenomenological model.*

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## Introduction

Particularly during early childhood and in elementary school, drawing and coloring have an important place in children's lives. In this regard, drawing and coloring books are important for the education of children; in America alone, the sector producing these books is worth 230 million United States Dollars [USD] (Raugust, 2003), while Jana (2007) has reported that the sale of crayons alone in 80 different countries of the world yields a USD500m financial turnover. These numbers can be seen as evidence of the importance of drawing and coloring activities in the daily lives of children. In addition, drawing and coloring are frequently used, not only in the daily lives of children, but also in school, enabling children to have a good time and educational activities to be more effective and efficient (Karniol, 2011). Such activities are widely used, particularly within the context of preschool education (İnan, Trundle & Kantor, 2010).

Although drawing and coloring are considered to be overtly artistic or unimportant in educational settings (Villarroel, 2016), it is clear that colors can have a considerable effect on both cognitive development and cognitive processes, such as describing objects. Kimura, Wada, Yang, Otsuka, Dan, Masuda, Kanazawa and Yamaguchi (2010) found that children, aged between five and eight months, can describe objects with the help of colors, particularly at the sixth month stage. According to the authors, a baby can distinguish yellow from red and blue from green when he/she is three-months-old. In addition, it was revealed by Hayakawa, Kawai and Masataka (2011) that colors are affective in terms of recognizing and making sense of objects. The authors reported that children can recognize a black and white object within a photo more slowly than a colorful counterpart in the same photo, while they emphasize the effect of colors as cognitive stimulators, as well as on the functioning of the brain, as the reason for this difference. Proverbio, Burco, del Zotto and Zoni (2004) stress that, during the process of object identification, the brain recognizes colors faster than shapes, such that individuals can produce appropriate emotional and physical responses to an object or an entity.

Recognized as cognitively quite effective in making sense of life and its component elements, drawing and coloring are also an important technique within early childhood research. The most important reason for

this is the belief that children reflect their feelings and opinions in their drawings (Yavuzer, 2010). In addition, drawings are effective in the elicitation of mental constructs about concepts, as well as feelings and opinions (Chang, 2011 & 2012).

Coloring and children's preferences for colors have been a topic of psychological research for a long time. While some studies (Burkitt & Newell, 2005; Burkitt & Sheppard, 2014; Cohen, 2013) have emphasized the importance of the effect of culture and social life on color preferences, others (Byrnes, 1983; Jadva, Hines & Golombok, 2010; Karniol, 2011; Lawler & Lawler, 1965; Navarro, Martinez, Yubero & Larranaga, 2014) have argued that cognitive and biological processes are influential on color selection. Lawler and Lawler stated that it is difficult to determine the effect of culture on color selection; yet, biological factors (e.g., gender) can be more effective in explaining the color selection. Moreover, there are some studies maintaining that senses have a direct influence on the selection of colors (Zentner, 2001). Boyatzis and Varghese (1994) argued that children select bright colors in order to express their positive feelings and dark or weak colors to express their negative feelings. In addition, age is reported to be one of the factors affecting color selection. Terogt and Hoeksma (1995) pointed out that younger children are more sensitive in terms of associating feelings with colors; with increasing age, this correlation gets lost. The common belief in the literature based on all this research is that color preferences are affected by many different variables. On the other hand, drawings are potential sources of information about how children feel about objects and individuals in their lives (Burkitt & Newell, 2005).

In this regard, the aim of the current research is to explore preschool children's drawings about flora and color preferences. Thus, the current research intends to understand the preschool children's knowledge of plants and the lives of plants, as well as determine the variety of colors used by them through drawings.

Plants and the lives of plants are not easy subjects for children to understand during early childhood. It can be difficult for these children to decide whether plants are living or nonliving entities. Gatt, Tunnicliffe, Borg and Lautier (2007) found that Maltese children could not classify trees and cacti as plants, nor could they be certain about whether plants are living or nonliving. According to Şahin and Aydın (2009), one of the reasons behind this phenomenon is that children are cognitively under the influence of animistic thinking. In Piaget's works (1930), it is frequently emphasized that plants are classified by children as nonliving, mostly due to their lack of ability to move. In addition to these stated reasons, another important reason might be that plants do not capture the interest of children as much as animals (Prokop & Fancovicova, 2014). This is also reflecting in textbooks. Link-Perez, Dollo, Weber and Schussler (2010) found that, in elementary school textbooks, the number of animal pictures and species is higher than the number of plant pictures and species, which in turn affects the content of the textbooks. On the basis of this finding, Wandersee and Schussler (1999 & 2001) introduced the term "plant blindness" to the field of biology education. The researchers define plant blindness as (a) humans' not recognizing and realizing plants around them, (b) humans' not understanding the importance of plants for the biosphere and humans, (c) humans' not understanding the aesthetic and biological features of plants and (d) humans' believing that animals are more useful than plants for humans, due to the former's anthropocentric viewpoint. Such beliefs held by people are claimed to result from the erroneous approaches adopted by biologists and biology and science educators (Wandersee & Schussler, 2001). The literature (Gatt et al., 2007; Wandersee & Schussler, 1999, 2001; Yorek, Şahin & Aydın, 2009) emphasizes that the world of plants should be introduced to children during early childhood in the course of educational-instructional processes.

In the preschool education program in Turkey, the subject of plants is taught as part of science activities. The education program implemented in Turkey is a development-based program. The anticipated outcomes of the program are organized according to the areas of development. In this program, there is no direct outcome concerning plants. Yet, within the program, there are some days and weeks to be celebrated, such as Environment Protection Week and Forest Week (MEB, 2013). The outcomes to be achieved by students during such events are also incorporated into the curriculum.

Within the context of the current research, preschool children were involved in the research. As preschool education lays the ground for academic education to be received by children, education given about plants is believed to be important during this stage of schooling.

The current research seeks answers to two main questions: (a) in the drawings by preschool children, are there any dependence between the colors used and gender and age? (b) if there are, do the colors selected by the children in their drawings match the basic level of education they receive? Within the context of these two questions, it is intended to gain some insights into the children's knowledge of plants through their own artworks, as well as into the development of biology-based information about the world of plants.

## Methodology of Research

This research is a qualitative research and its model is phenomenology. Phenomenology research are the ones whose purpose is to have deep understanding of participants' perceptions and reactions towards a concept (Fraenkel & Wallen, 2008). This phenomenon can be one we face in our daily life frequently (Creswell, 2007). This situation does not mean that sufficient knowledge on that phenomenon. Phenomenology research are the ones which provide a base for detecting this insufficiency (Yıldırım & Şimşek, 2008; 72). In phenomenology research, the purpose of the researcher is to detect knowledge, belief and perception of the participants (Fraenkel & Wallen, 2008).

The current research employed one of the qualitative research models, namely, the phenomenological research model. Phenomenological research enables the researcher to collect in-depth information about a phenomenon. In such research, it is assumed that participants have some experiences related to the phenomenon. The phenomenon of interest in the current research is plants. Each child was asked whether or not they had any experience related to plants.

### *Sample*

Sample of the current research comprised a total of 80 preschool children (40 girls and 40 boys) from the city of Kastamonu in the fall term of the 2016-2017 school year. Of the participating children, 21 were aged four years (26.3%) and 59 were aged five years (73.8%). While four years old children are in their first year in pre-school education, five years old children are on their second. All of the children in sample group are studying in same pre-school. While the school is state funded, all of the children are from middle-class families. As it was intended that the existing state would be discovered within the context of the study, the sample was constructed by means of a typical case sampling method. Purpose of the typical case sampling method is to reach the most "average" and the most "ideal" group and by doing this makes it easy to conclude on a general opinion. Information about the sample is presented in Table 1.

**Table 1. Distribution of the children in the sample.**

| Age | Girl | | Boy | | Total | |
|---|---|---|---|---|---|---|
| | F | % | f | % | f | % |
| Four years (M = 43 months, df = 3.1) | 10 | 25.0 | 11 | 27.5 | 21 | 26.3 |
| Five years (M = 62 months, df = 3.1) | 30 | 75.0 | 29 | 72.5 | 59 | 73.8 |
| Total | 40 | 100.0 | 40 | 100.0 | 80 | 100.0 |

### *Tasks*

Within the context of the research, the children were asked to make drawings about the world of plants and to color their drawings. These drawings were made in the class at a suitable time determined in advance on the basis of the opinions of the school management and the classroom teacher. The children were seated in groups of four in line with the physical capacity of the classroom. Each child worked individually on their drawings. In order to minimize interaction within the groups, the teacher and the researcher showed interest in the groups one by one while they were drawing.

Prior to the initiation of the drawing task, necessary information was given to the classroom teachers. Although the script prepared for the puppet to be used during the task was written under the guidance of an expert on drama instruction in preschool education, this script was re-examined together with the teachers before they granted their approval. None of the teachers requested any changes to the script.

In research focusing on preschool education, using a puppet is a popular strategy for collecting data (e.g., Aknin, Hammlin & Dunn, 2012; Villarroel, 2016; Villarroel, Minon & Nuno, 2011). In the current research, the puppet was used by the researcher and known as Bitta. The name of the puppet has no meaning in Turkish; rather, it was selected because it is an easy name to pronounce and similar to that of the researcher). It was assumed that Bitta had no knowledge of plants and was curious about these living things he frequently encountered. He wanted to know many things about plants, but needed help from the children. As such, Bitta asked the children to draw a colorful plant for him, wondering what plants look like, how they feed, what they need to survive and where they can live. After Bitta asked these questions, the children started drawing.

For the drawings, A4-sized paper was used. For coloring, pastels were provided by the researcher. The researcher preferred Monami pastels, which are sold in a set of 12. This brand of pastels can be easily obtained from any stationer's shop in Turkey. This brand of pastels also has a European Safety Standards EN71-3 (heavy metal test) certificate. The colors that can be found in this set of pastels are black, light and dark brown, yellow, light and dark blue, orange, white, red, light and dark green, and gray. The drawing tasks conducted in the classroom were generally completed within 20 minutes. The age and gender of the children were written on the back of the respective drawing papers. No other information or voice/video recording was collected from the children.

### *Data Analysis*

In the current research, information about the children's age, gender and grade level was used as the variables of the study. In addition, visuals in the drawings, colors used in the drawings and the colored surface area represented the other variables of the study. In order to conduct the required operations, particularly on visuals, all the drawings produced by the children were transferred to an electronic medium using a scanner. In order to carry out surface area calculations, the visuals were scanned in the TIFF format with a 300dpi resolution and recorded. In order to carry out surface area calculations on the TIFF files, the ImageJ program was used (http://rsb.info.nih.gov/ij). This program is free and widely used for similar purposes.

From among statistical tests, *chi-square* was employed for relational categorical variables (e.g., gender and color), while *phi* (Pallant, 2015) was used to calculate the effect size. Given that the data did not show a normal distribution within the comparative analyses conducted for qualitative variables (Kolmogorov-Smirnov test, *p*-value .02), as a result of the Levene Test, the *p*-value was calculated to be .03, the skewness value was found to be .73 and the kurtosis value was found to be .81; nonparametric tests were also used (Pallant, 2015). For difference statistics, the Mann-Whitney U Test was run and, for the effect size, the *r*-value (*r*) was calculated (Pallant, 2015). For the analyses, .05 was used as the *p*-value.

## Results of Research

Regarding the findings about the children, the figures in their drawings and the distribution will first be discussed. Then, the findings related to dependence between the numbers of colors used in the drawings and gender and age were presented, after which the surface areas of the colors used and their dependence with age and gender will be addressed.

### *Analysis of Drawings Elements*

Of the drawings by the 80 children involved in the research, a total of 21 different figures were identified. In the drawings, 21 different figures were drawn 237 times. The distribution of these figures across the ages is given in Table 2. As the focal point of the research is plants, from among the figures obtained, the figures of grass, tree, sun, rain and soil were separately analyzed, while the effect of age and gender on the drawing of these figures was also examined. As a result of these analyses, no significant correlation was found between age and the figures of: grass $\chi^2$ (1, n = 80) = .23, p = .71, phi = .23; tree $\chi^2$ (1, n = 80) = .66, p = .77, phi = .66; sun $\chi^2$ (1, n = 80) = 2.65, p = .103, phi = .21; rain $\chi^2$ (1, n = 80) = 1.05, p = .3, phi = .14; flower $\chi^2$ (1, n = 80) = .21, p = .65, phi = -.91; and soil $\chi^2$ (1, n = 80) = 1.04, p = .3, phi = .15.

No significant correlation was found between gender and the figures of: grass $\chi^2$ (1, n = 80) = 2.79, p = .95, phi = .21; tree $\chi^2$ (1, n = 80) = 2.48, p = .2, phi = .2; rain $\chi^2$ (1, n = 80) = 3.26, p = .71, phi = -.23; flower $\chi^2$ (1, n = 80) = .08, p = .34, phi = -.14; and soil $\chi^2$ (1, n = 80) = 1.68, p = .19, phi = -.18. Meanwhile, a significant correlation was found between the figure of sun and gender $\chi^2$ (1, n = 80) = 5.15, p = .02, phi = -.27 in respect of the girls.

**Table 2. Elements found in the drawings and their distribution.**

| Category | Figures found in the drawings | % | f |
|---|---|---|---|
| World of plants | Tree, flower, grass, seed, cactus | 48.9 | 116 |
| Atmospheric elements | Sun, cloud, rain, rainbow, smoke | 32.9 | 78 |
| Elements related to the world of plants | Soil | 4.64 | 11 |
| Other living things | Human, domestic animal, fish, bird | 7.17 | 17 |
| Decorative figures | House, car, balloon, road, heart | 6.32 | 15 |
| | Total | 100.0 | 237 |

**Figure 1: A sample drawing by a four-year-old child.**
Elements found in the drawing: flower, soil, rain, sun, grass, seed and cloud

Sample drawings from different age groups are given above. Other samples from the drawings produced as a result of the current research are given in Appendix 1.

*Findings Related to the Colors, and Drawn Surface Areas*

During the data collection process, the children were given pastels in a set of 12. The number of colors used by the children varied between one and eight. The number of colors used by the children depending on their age and gender is given in Table 3. The Mann-Whitney U test revealed that, while no statistically significant correlation was found between the number of colors used by the children and age ($U = 479$, $z = -1.55$, $p = .11$, $r = .17$), a statistically significant correlation was found between the number of colors and gender ($U = 598.5$, $z = -1.96$, $p = .04$, $r = .21$). It can be seen in Table 3 that the girls used more colors in their drawings ($Md = 5$, $n = 40$) than the boys ($Md = 4$, $n = 40$).

**Table 3. Distribution of the number of colors used by the children according to their age and gender.**

| Age | Number of colors used | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | Total | |
| | *f* | % | *f* | % | *f* | % | *f* | % | f *f* | % | *f* | % | *f* | % | *f* | % | *f* | % |
| Four years | 2 | 40 | 6 | 42.9 | 2 | 25 | 5 | 29.4 | 2 | 13.3 | 1 | 7.1 | 2 | 40 | 1 | 50 | 21 | 26.3 |
| Five years | 3 | 60 | 8 | 57.1 | 6 | 75 | 12 | 70.6 | 13 | 86.7 | 13 | 92.9 | 3 | 60 | 1 | 50 | 59 | 73.8 |
| Total | 5 | 100 | 14 | 100 | | 100 | 17 | 100 | 15 | 100 | 14 | 100 | 5 | 100 | 2 | 100 | 80 | 100 |
| **Gender** | **Number of colors used** | | | | | | | | | | | | | | | | | |
| | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | Total | |
| | *f* | % | *f* | % | *f* | % | *f* | % | *f* | % | *f* | % | *f* | % | *f* | % | *f* | % |
| Girls | 2 | 40 | 5 | 35.7 | 6 | 75 | 4 | 23.5 | 8 | 53.3 | 10 | 71.4 | 3 | 60 | 2 | 100 | 40 | 50 |
| Boys | 3 | 60 | 9 | 64.3 | 2 | 25 | 13 | 76.5 | 7 | 46.7 | 4 | 28.6 | 2 | 40 | 0 | 0 | 40 | 50 |
| Total | 5 | 100 | 14 | 100 | 8 | 100 | 17 | 100 | 15 | 100 | 14 | 100 | 5 | 100 | 2 | 100 | 80 | 100 |

Information about the colors used in the children's drawings and the surface areas of these colors ($cm^2$) is given in Table 4. The drawings of the 80 children covered a total area of 1,148.32 $cm^2$. The mean drawing area of the four-year-old children was 10.55 $cm^2$ and the total area covered by their drawings was 221.73 $cm^2$. On the other hand, the mean drawing area of the five-year-old children was 15.7 $cm^2$ and the total area covered by their drawings was 926.59 $cm^2$. The first three colors covering the largest area were light green (2,12.84 $cm^2$), light blue (187.8 $cm^2$) and yellow (141.35 $cm^2$). As a result of the inferential statistics conducted, no significant correlation was found between age and the area covered by any color. In terms of the correlation between gender and the area covered by the colors, a significant correlation was found only with light green in favor of the girls ($U = 358$, $z = -2.92$, $p = .003$, $r = .32$); no significant correlation was found with the other colors. The girls covered a larger area with the color of light green in their drawings than the boys. No such dependence was found with the other colors.

**Table 4. Surface areas covered by the colors used in the drawings ($cm^2$).**

| Color | Mean ($cm^2$) | Standard deviation |
|---|---|---|
| Light green | 4.09 | 10.6 |
| Black | 3.91 | 9.3 |
| Dark green | 3.88 | 11.5 |
| Light blue | 3.68 | 3.6 |
| Dark blue | 3.64 | 3.3 |
| Dark brown | 3.62 | 13.1 |
| Light brown | 3.18 | 12.4 |
| Red | 3.12 | 3.4 |
| Yellow | 2.77 | 5.4 |
| Gray | 1.84 | 6.8 |
| Orange | 1.82 | 7.2 |
| White | 0.05 | 13.1 |

**Discussion**

The findings of the current study revealed that the children frequently used the figures of tree (*f* = 19, 23.7%), flower (*f* = 68, 85%) and grass (*f* = 26, 32.5%) in their drawings about the world of plants. Flower was the most frequently drawn element in the category of the world of plants. Moreover, elements directly related to plants, such as sun (*f* = 33, 41.2%) and rain (*f* = 21, 26.2%), were widely used by the children in their drawings. Another important finding of the current study is that some of the children (*f* = 11, 13.7%) included the element of soil in their drawings. On the basis of all these findings, it can be argued that the children receiving preschool education possess adequate knowledge about plants and their lives in terms of the level of education they are undergoing. Although no statistically significant correlation was found between age and the elements of grass, tree, flower, sun, rain and soil, it was found that, with increasing age, the number of elements related to plants (e.g., soil, rain, seed) used in the children's drawings also increased. Thus, it can be concluded that, with increasing age, children can more easily establish links between the world of plants and sun, soil and rain. Yörek, Şahin and Aydın (2009) emphasized that the first information about living things is received during universal education and, for this information to develop on a scientific basis, basic-level scientific process skills should be imparted to children as early as possible (İnan, Trundle & Kantor, 2010).

As a result of this research, it was found that, with increasing age, the surface area covered by drawings also increased. The five-year-old children used an area that was, on average, 5 $cm^2$ more in their drawings compared to the four-year-old children. In terms of the children's color preferences, light green, black, dark green and light blue seemed to be the colors covering the largest areas in the drawings. In the drawings on the theme of plants, the wider use of the shades of green and the color of blue was an expected result. Green and shades of green were mostly used in the illustration of trees, grass and leaves. Light blue was mostly used in the illustration of clouds and rain. Black, on the other hand, was mostly used by the children to illustrate soil and mark the contours of certain figures. Another finding related to the preference of colors in the pastel set was that light colors were preferred more than dark colors.

Thus, on the basis of the children's preferences for colors in their drawings, it can be argued that the children indicated a realistic thinking-based canonic perception of colors in general because the children typically used green to paint trees, brown to paint tree trunks, and yellow or orange to paint the sun. No statistical dependence was found between the color preferences and age and gender. Moreover, when the children's color preferences for the plants in their drawings are considered, it can be concluded that the five-year old children indicated a detailed knowledge of the world of plants.

The preference for color is an important research area in different disciplines (e.g., psychology, experimental psychology). Neurobiologically, the human brain uses the color of an object or entity (canonic color) to define this object or entity (Kimura et al., 2010). Hayakawa, Kawai and Masataka (2011) stated that colors can provide important clues for the brain to identify objects and, through colors, the brain can be faster at distinguishing and processing the characteristics of an object. Therefore, the children's preference for canonic colors in the current study (e.g., yellow for sun, green for leaf, brown for soil) indicated basic-level information about these concepts. Moreover, the children's preference for light, rather than dark, colors may be explained by affective reasons. Research (Karniol, 2011; Burkitt & Sheppard, 2014; Jadva, Hines & Golombok, 2010) shows that light and pastel colors are more effective at stimulating children's senses, particularly up to the age of six years. Moreover, while boys prefer striking colors, such as red and blue, more than girls (Burkitt & Newel, 2005), they tend to use light shades of these colors (Byrnes, 1983). In a study conducted by Villarroel (2016), it was also found that children used light and pastel colors more, while older children (five- and six-year-olds) used canonic colors more than younger children. Although culture, history and social life can influence color preferences (Cohen, 2013), the findings of the current study concurs with the findings reported by Villarroel (2016).

*Educational Implications*

Drawings are effective tools for the understanding of knowledge in the brain (White & Gunstone, 2000). Although coloring is a part of the drawing process, research has revealed that there is a dependence between color preferences and knowledge of science concepts (Savva, 2014; Villarroel, 2016; Villarroel & Ros, 2013). Particularly during the preschool stage, drawing and coloring activities performed within the context of science education positively affect the learning process (Çiftçi & Temel, 2010; Inan, Trundle & Kantor, 2010).

## Conclusions

In this research, children's knowledge on the plants has been tried to be defined by studying of their drawings and the colors chosen by them. It is specified that children have a canonical color perception in the drawings about a plant. Accordingly, children generally draw leaves as green, bole and soil as brown and flowers in different colors. Villarroel (2016) underlines that canonical color usage may show that the individual has right knowledge on it. It is seen, as expected, that children used green and brown and their light and dark tones more frequently. Furthermore, it is seen that children have knowledge on the nature of the plants because their drawings include factors like sun, soil, and rain. Biology is included lesser than other disciplines in science education on the preschool term. Activities favored by children like drawing can be used for giving biology education and this can be helpful on closing this deficiency.

## Recommendation

Activities in science and other disciplines, when conducted in tandem with drawing tasks, are believed to be effective in terms of children's learning the concepts of these disciplines and in developing their knowledge of them. Being an important and enjoyable part of daily life for children, drawing and coloring activities can help students respond positively to the learning processes they are undergoing at school during the preschool stage.

The current research was conducted with a very small group. Given that color preference is an issue, which is associated with different disciplines, interdisciplinary studies should be conducted so that an important void in the literature related to color preference and canonic color perception processes can be filled. Moreover, adaptation of drawing- and coloring-based research methodology by disciplines, other than scientific ones, will result in rich data and knowledge.

## References

Aknin, L., B., Hamlin, J., K. & Dunn, E., W. (2012). Giving leads to happiness in young children. *PLoS ONE, 7* (6), e39211.

Boyatzis, C., J. & Varghese, R. (1994). Children's emotional associations with colors. *The Journal of Genetic Psychology, 155* (1), 77-85.

Brynes, D., A. (1983). Color associations of children. *The Journal of Psychology, 113* (2), 247-250.

Burkitt, E., & Newell, T. (2005). Effects of human figure type on children's use of colour to depict sadness and hapiness. *International Journal of Therapy, 10* (1), 15-22.

Burkitt, E., & Sheppard, L. (2014). Children's colour use to portray themselves and other with happy, sad and mixed emotion. *Educational Psychology, 34* (2), 231-251.

Chang, N. (2011). What are roles children's drawings play in inquiry of science concepts? *Early Child Development and Care, 181* (1), 1-7. DOI:10.1080\03004430.2011.569542.

Chang, N. (2012). The role of drawing in young children's construction of science concepts. *Early Childhood Education Journal, 40*, 187–193.

Cohen, P. N. (2013). Children's gender and parents' color preferences. *Archives of Sexual Behavior, 42* (2), 393-397.

Creswell, J. W. (2007). *Qualitative inquiry & research design: Choosing among five approaches.* (2nd Edition). London: SAGE.

Fraenkel, J. R., & Wallen, N. E. (2008). *How to design and evaluate research in education.* (7th Edition). New York: McGraw-Hill.

Gatt, S., Tunnicliffe, S., D., Borg, K. & Lautier, K. (2007). Young Maltese children's ideas about plants. *Journal of Biological Education, 41* (3), 117-122.

Hayakawa, S., Kawai, N., & Masataka, N. (2011). The influence of color on snake detection in visual search in human children. *Science Report, 1* (80). DOI: 10.1038/srep00080(2011).

Inan, H. Z., Trundle, K. C. & Kantor, R. (2010). Understanding natural sciences education in a Reggio Emilia-inspired preschool. *Journal of Research in Science Teaching, 47* (10), 1186-1208.

Jadva, V., Hines, M., & Golombok, S. (2010). Infants' preferences for toys, colors, and shapes: Sez differences and similarities. *Archives of Sexual Behavior, 39* (6), 1261-1273.

Jana, R. (2007, January 26). Crayola brigtnes a brand. *BusinessWeek Online.* Retrevied from www.businessweek.com/innovate/content/jan2007/id20070126_338855.htm.

Karniol, R. (2011). The color of children's gender stereotypes. *Sex Roles,* (65), 119-132.

Kimura, A., Wada, Y., Yang, J., Otsuka, Y., Dan, I., Masuda, T., Kanazawa, S. & Yamaguchi, M., K. (2010). Infants' recognition of objects using canonical color. *Journal of Experimental Child Psychology,* (105), 256-263.

Lawler, C., O., & Lawler, E., E. (1965). Color-mood associations in young children. *The Journal of Genetic Psychology, 107*(1), 29-32.

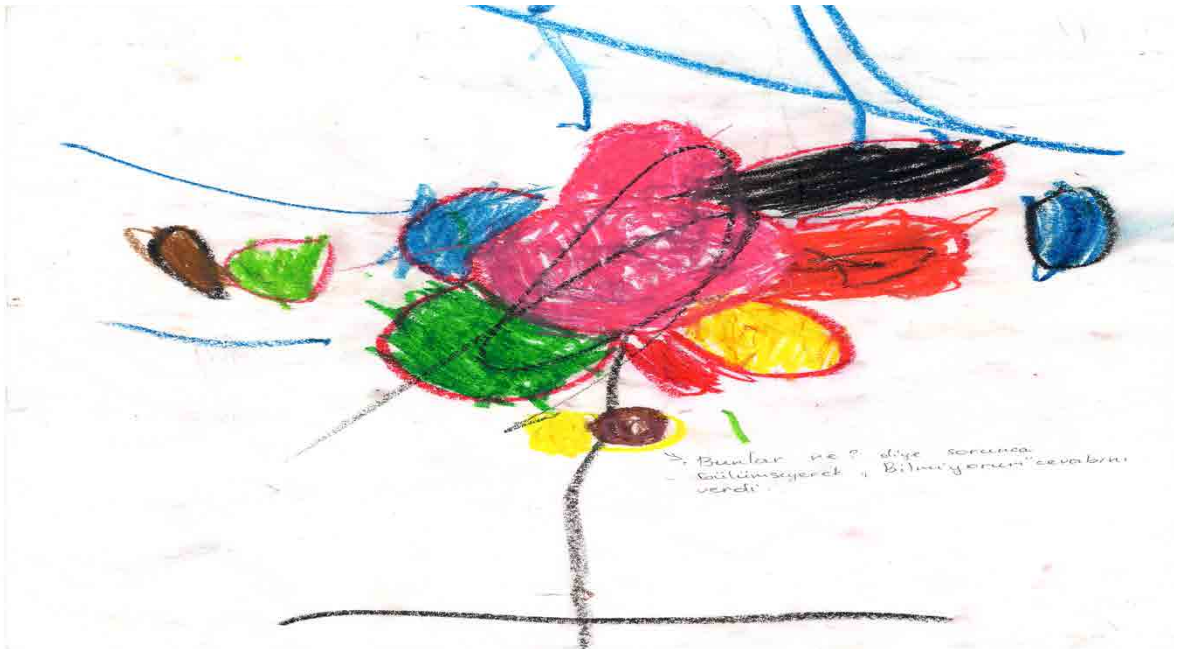
Link-Perez, M., A., Dollo, V., H., Weber, K., M. & Schussler, E., E. (2010). What's in a name: Differential labelling of plant and animal photographs in two nationally syndicated elementary science textbook series. *International Journal of Science Education, 32* (9), 1227-1242.

Navarro, R., Martinez, V., Yubero, S. & Larranaga, E. (2014). Impact of gender and the stereotyped natüre of illustrations on choice of color: Replica of the study by Karniol (2011) in a Spanish sample. *Gender. Issues,* (31), 142-162.
Pallant, J. (2015). *SPSS survival manual*. Sydney: Allen&Unwin.
Piaget, J. (1930). *The child's conceptions of the world.* London, UK: Routladge & Kegan Paul.
Prokop, P., & Fancovicova, J. (2014). Seeing coloured fruits: Utilisation of the theory of adaptive memory in teaching botany. *Journal of Biological Education, 48* (3), 127-132.
Proverbio, A. M., Burco, F., del Zotto, M. & Zoni, A. (2004). Blue piglets? Electrophysiological evidence for the primacy of shape over color in object recognition. *Cognitive Brain Research, 18*, 288-300.
Raugust, K. (2003). A shifting market. *Publishers' Weekly, 250* (44), 46-48.
Savva, S. (2014). Year 3 to year 5 children's conceptual understanding of the mechanism of rainfall: A comparative analysis." *Ikastorratza e-Revista de Didáctica, 12*. Retrevied from http://www.ehu.es/ikastorratza/12_alea/rainfall.pdf.
Terwogt, M. M., & Hoeksma, J. B. (1995). Colors and emotions: Preferences and combinations. *The Journal of General Psychology, 122* (1), 5-17.
Villarroel, J. D. (2016). Young children's drawings of plant life: A study concerning the use of colours and its relationship with age. *Journal of Biological Education, 50*(1), 41-53.
Villarroel, J. D., I. Ros. (2013). Young children's conceptions of rainfall: A study of their oral and pictorial explanations. *International Education Studies 6* (8), 1–15.
Villarroel, J. D., Minon, M., & Nuno, T. (2011). The origin of counting: A study of the early meaning of 'one', 'two' and 'three' among Basque and Spanish speaking children. *Educational Studies in Mathematics, 76* (3), 345-361.
Wandersee, J. H., & Schussler, E. E. (1999). Preventing plant blindless. *The American Biology Theacher, 61* (2), 82-86.
Wandersee, J., H. & Schussler, E., E. (2001). Toward a theory of plant blindless. *Plant Science Bulletin, 47*(1), 2-8.
White, R., & Gunstone, R. (2000). *Probing understanding* (4th Edition). London: The Falmer.
Yavuzer, H. (2010). *Resimleriyle çocuk* [Child with his/her pictures] (10. Basım). İstanbul: Remzi.
Yıldırım, A., & Şimşek, H. (2008). *Sosyal bilimlerde nitel araştırma yöntemi* [Qualitative method in social sciences] (7. Baskı). Ankara: Seçkin.
Yorek, N., Şahin, M., & Aydın, H. (2009). Are animals 'mor alive' than plants? Animistic-anthropocentric construction of life concept. *Eurasia Journal of Mathematics, Science & Technology Education, 5* (4), 369-378.
Zentner, M., R. (2001). Preferences for colours and colour-emotion combinations in early childhood. *Developmental Science, 4* (4), 389-398.

## Appendıx 1. A sample drawing by children

**Drawing 1. A sample drawing by a five-year-old child**

Elements found in the drawing: Flower, cloud, sun house.



**Drawing 2. A sample drawing by a four-year-old child**
Elements found in the drawing: Flower.


**Drawing 3. A sample drawing by a five-year-old child**
Elements found in the drawing: Flower, Tree, Sun and Grass.

**Drawing 4. A sample drawing by a five-year-old child**
Elements found in the drawing: Flower, cloud, sun and rainfall.

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