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# Effect of Frostig Visual Perception Training Program on Visual Perception Skills of First Graders

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## ABSTRACT

The study aimed to examine effectiveness of a visual perception training program upon an application period of 14 weeks on primary school first graders. Effects of the *Frostig Visual Perception Training Program* were evaluated within demographics of gender, age, parental education level, previous kindergarten attainment and family income. The sample group consisted of first graders between the ages of 5-7 at a public primary school in Bursa, Türkiye. The study as an experimental model was designed based on screening-model sampling and conducted in the 2017-2018 academic year. Upon Pretest application of the visual perception instrument, *Frostig Visual Perception Training Program* was administered to the Treatment group once a week as part of art classes during 14 weeks. Visual perception skills of children were measured before and after training to examine, analyze and evaluate the developmental capacities and scope of children's visual perception. While there was no significant difference between the Treatment and Control groups at the beginning, Post-test results showed a significant difference between cohorts upon training and utilization of *the Frostig Visual Perception Training Program*. Results were also compared based on various demographics. It was conclusively supported by the findings that *the Frostig Visual Perception Training Program* contributed to the children's visual perceptive abilities positively. It was also concluded that visual perception development may contribute to children's development to support early literacy-skill development. Therefore, art classes may play a central role especially for preschool and early grade levels.

**Key words:** Visual Arts Education, Art Education, Reading, Writing, Kindergarten, Literacy

## INTRODUCTION

Cognitive processes begin with perception. Individuals construct their own subjective perceptions through senses that communicate through and within surrounding environment. Therefore, consciousness is a subjective cumulative response built upon cognitive and perceptive processes (Hançerlioğlu, 1990). Evidently, perception is a construct shaped by not only environmental stimuli but also through subjective measures. Empirical evidence suggested that perception changes over time and these changes can be measured (Cüceloğlu, 2003).

Brain has a crucial role in managing perceptive processes through evaluation of variables such as past experiences, emotional responses, physical conditions, personal expectations from life, and social and cultural values. In this perceptive process, the brain behaves selectively and may prioritize, accentuate or ignore particular senses, and makes inferences when there are gaps between the information. Meaning making is a subjective process that is generated through these sophisticated interdependent interactions (Ayaydın et al., 2009). Meaning making is an individual survival mechanism that helps us perceive, understand, interpret, shape and bend occasional realities, social situations and environment based on subjective survival needs.

Perception also provides attention development in the process of comprehension and interpretation. While individual moves through attentive skills, he also has to manage senses, cognitive capacities and processes (Kandır, 2003). Perception is a complex process that is also influenced by learning and past experiences (Sökmen, 1994). It serves us to compare feelings through cognitive measures so that we could make sense of situations in our living environments (Frostig & Maslow, 1973). Perception is diversified through tactile, visual, auditory and other stimuli and is described accordingly as various perception types.

Visual perception is typically considered as the most fundamental form of perception and that is because visual information collected through eyes helps us process enough perceptive information to comprehend the world and to move in physical environment. Consequently, perceptive processes rely heavily on visual information (Farroni & Menon, 2008; Erben, 2005). Children's perceptive developments are shaped in manifold processes and in various forms during school age when there is an active learning process.

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Perception skills have a significant role in learning and literacy skills by means of transcribing stimuli collected through various senses such as eyes and ears, then interpreting them in the brain (Cohen & Cowen, 2008).

Seeing starts through a physiological process in the eyes. The human eye is sensitive to light rays between only certain wavelengths. Rays coming from a light source or reflected through objects pass through the lens of the eye. Those rays stimulate the nerves, the stimuli then are processed and evaluated in certain parts of the brain which is called visual center (Aral, 2010). However, in order for the data transmitted to the brain to be deemed worthy of coding, the individual's attention should be focused on information; therefore, it is directly proportional to his focus and attention (Sağol, 1998) but with simple terms having the biological ability to see is a sufficient precondition for visual perception (İnceoğlu, 2004).

Frostig (1964) defined visual perception as the ability to recognize, identify and evaluate received stimuli through previous experience (Aral et al., 2001). It was also emphasized that having a good eyesight is not enough for visual perception; perceptive mechanism is further processed and finalized in the brain (Frostig, 1968, p. 26). In today's world we are exposed to excessive number of visual stimuli every day. Visual perception requires acknowledging of visual stimulus. We have to learn to look carefully to detect and recognize these stimuli in a timely manner (Çağatay & Mangır, 1990, p. 96).

First, visual stimulus needs to attract attention of the subject, then has to respond to a particular need and has to have appropriate qualities to be perceived. The individual also has to be ready psychologically and physically for the act of seeing and perception. Individual perceptive processes manage what we want to see and what is worth to be seen within a complex visual environment. However, perception is also shaped through personal choices, experiences and references. This sophisticated process is not completely managed through conscious measures but rather closely related to the individual's past cognitive experiences.

Research showed that cognitively apt children made progress in their problem-solving skills through visual perceptive performance training (Ercan, 2009, pp. 39-42). Aral and Erturan (1999) recommended the use of the *Frostig Development Test of Visual Perception* as a useful instrument for identification of visual perceptive abilities of 4-8-year-old children. *The Frostig Visual Perception Training Program* is also developed to support perceptive developmental process and to increase visual perceptive abilities. Some researchers suggested that visual-spatial inadequacy and low visual perception skills may have been the leading causes of language problems among children with reading difficulties. Visual perception related problems may also cause problems with bodily perceptive abilities such as motor skills, coordination, balance and behavioral control. The child may experience difficulty with simple tasks such as climbing stairs and riding bicycle (Bumin, 1998; Kelkar & Sanghavi, 2005). Early identification and training are suggested to minimize these problems. The researchers also emphasized the significance of introducing rich visual stimuli to children during their elementary education ages to support needed background for their in progress visual perceptive developments and to prevent possible problems they may experience in their daily lives and in the classroom (Aral, 2010; Ercan, 2009). Art classes deemed to be useful to prepare needed background and skills. Evaluation strategies and approaches in art education prioritize observation and identification of children's development. Specifically, alternative evaluation approaches of new curricular models that examine the learning processes in art suggested to be beneficial.

The current study aimed to investigate possible contributions of *Frostig Visual Perception Training Program* within various demographic variables. The study also aimed to examine contributions of art classes to the educational objectives of children's cognitive, sensory and psychomotor developments; therefore, the study may also serve understanding first grade level students' cognitive developments through visual perception training.

### Objective and Research Question

Art curriculum is designed to support various educational objectives including supporting children's aesthetic sensitivity, awareness and perceptive developments. The study aimed to measure the visual perception skills of children before and after visual perception training to investigate effectiveness of the *Frostig Visual Perception Training Program.* Expected outcomes of the training program may contribute to new curriculum approaches such as helping with planning particular art lessons, strategies and classroom practices. Respectively, the study intended to examine, analyze and evaluate developmental capacities and scope of children's visual perception. Results were also compared based on various demographics as clarified in the research questions below.

1. Does visual perception training contribute to visual perception skills of first-grade students?
2. Does visual perception development differentiate in relation to gender, age, parents' education, previous kindergarten education, and family income?

## LITERATURE REVIEW

Studies showed that visual perception skills help elementary level students with their literacy skills and also help learning retainment more effectively compared to upper grade levels. Therefore, visual perception skills acquired during early childhood enable children to learn problem solving skills and also support creative thinking by means of learning cause-effect reasoning, furthermore these skills support children's developments during all stages (Karaaslan & Şahin, 2006). Visual perception is shaped and influenced by various factors such as age, maturity, psychological and physiological problems. Children who are ready to acknowledge visual forms of letters may also show readiness to analyze and resolve details of events and objects, and relationships between parts and the whole when needed, through which skills they could manage their visual perception development (Arıkök, 2001, p. 89). In this respect, visual arts curriculum is designed to implement certain educational strategies which also include approaches to develop children's visual perception through educational interventions. Some of the visual perception related problems are inability to focus, selective perception, attention disorder, visual memory related issues, inability to interpret visual cues and symbols. These issues may also manifest themselves in various ways at early ages, such as confusing forms, difficulty with differentiating geometric shapes and making distinction between shape and background, difficulties with spatial positioning, confusing foreground/background relationships, and being unable to see details and nuances (Akdemir, 2006; Sağol, 1998). Children with visual perception problems may experience difficulties when doing even the easiest tasks. Such problems may persist when children start school, "the problem may manifest itself in various ways such as difficulty with differentiating similar letters and words" (Çağatay & Mangır, 1990, p. 63). Visual perception may also have effects on learning processes and visual perception problems are associated with learning difficulties (Yücelyiğit & Aral, 2013; Bezrukikh et al., 2009). Children with serious visual perception problems may require professional support as early as possible since these problems may hinder their developments in other areas as well. Perception is a process which consists of learning, memory, thinking and problem solving. All of these mechanisms are further shaped through emotions and mind. Therefore, visual perception contributes to imagination, drawing ability and productive skills (Çil et al., 1995). Children with visual perception problems may experience difficulties in everyday tasks such as writing, drawing, understanding, math calculations, problem solving and reading. Such negative experiences may further affect their self-confidence (Akaroğlu & Dereli, 2012).

Although visual perception shows a linear developmental process correlated with ages and children's developments in other areas, alternative interventions supporting visual perception skills are suggested (Ferah, 2007; Görener, 2006). Visual perception developments of children are still in progress since their physical and cognitive developments are not completed. Visual perception skills are shaped gradually by the age of nine and reach close to an adult's perception level by the age of twelve (Akaroğlu & Dereli, 2012). Educational talks and discussions are usually structured around children's social and emotional development, cognitive development and physical development. Nevertheless, visual perception may have a central and fundamental role and may have direct influence on all other developmental areas such as language development, cognitive development, social and cultural development (Dereobalı, 1994).

### Visual Perception Training

Looking and seeing are usually differentiated in relation to the concept of visual perception. In some cases, children with physically healthy eyesight may experience learning difficulties because of a visual perception problem and their problem might be rooted to misinterpretations of visual data in the brain (McWhirter & Acar, 2000).

The first step of children's visual perception training is listening skills. Listening skills require making eye contact and focusing attention. Auditory information is transferred to visual-motor actions and language, then perception and motor developments are connected in all occasions (Dereobalı 1994). Early childhood visual perception practices start with visually attractive tasks that are appropriate to age and developmental levels. While these training practices give them chance to learn by trial and error, they also discuss and reflect the results of their practices. During visual perception training, study sheets are designed to make learned skills long-lasting and cohesive, these practices in addition to drawing practices are also designed for reinforcement of learning processes (Arıkök 2001; Koç, 2002). These practices may be personalized according to the needs of every child. Group studies provide learning opportunities by making observations, sharing experiences with their peers, waiting their turn, learning communication, and self-actualization. Asking students to do these tasks without mistakes instead of doing the tasks in a short time, guiding them through the process, and providing feedback to teach them correcting their mistakes have crucial role in visual perception training (Koç, 2002).

## METHODOLOGY

The study aimed to examine effects of a visual perception training program upon an application period of 14 weeks on primary school first graders. Effects of the *Frostig Visual Perception Training Program* were evaluated within demographics of gender, age, parental education level, previous kindergarten attainment and family income. The sample group consisted of first graders between the ages of 5-7 at a public primary school in Bursa, Türkiye. The study as an experimental model was designed based on screening-model sampling and conducted in the 2017-2018 academic year. Upon Pretest application of the visual perception instrument, *Frostig Visual Perception Training Program* was administered to the Treatment group once a week as part of art classes during 14 weeks. The study aimed to measure the visual perception skills of children before and after training, and to examine, analyze and evaluate the developmental capacities and scope of children's visual perception. Children's visual perception developments are considered within literacy skills and curricular approaches to determine effective classroom practices.

### Research Design

The research was structured as an experimental study static group comparison within two phases. The first phase included screening and selection of typical sample groups to determine visual perception levels of Treatment and Control groups. Both sample groups were selected as similar groups and as representing typical homogenous characteristics of first graders. As a selection measure it was important that participants should have demographically represented typical first graders so that we could generalize the results to similar populations as a validity measure. Furthermore, as an experimental design the aim was to control external variables so that we could test the exact effects of intervention on the results (Creswell, 2014, p. 126).

**Table 1.** Experimental design phases of the study

| Group | Visual | Perception | Training Post-test |
|---|---|---|---|
| Treatment group (26) | Frostig Visual Perception Test | Frostig Developmental Visual Perception Training | Frostig Visual Perception Test |
| Control group(26) | Frostig Visual Perception Test | - | Frostig Visual Perception Test |

As shown in Table 1, at the beginning of the study the *Frostig Development Test of Visual Perception* was administered to the Treatment group and Control group, each group included 26 students. Gender demographics of the participants are shown in Table 2. For the second phase Treatment group was given *Frostig Developmental Visual Perception Training* for one class hour every week for a total of 14 weeks during art classes, control group was not administered any kind of intervention besides regular art curriculum activities. Following the end of the training period, both groups were administered a Post-test of *Frostig Development Test of Visual Perception*.

The study was conducted at an elementary school located in Bursa, a large industrial city in Türkiye. Treatment and Control groups were both selected from the same school. Groups included first graders between the ages of 5 to 7 with a median age of 6 for both groups, with a voluntary based participation along with parental consents. The study followed Bursa Uludag University ethics guidelines for research in social sciences and education with obtained permissions.

**Table 2.** Gender demographics

| Group | sex | *f* |
|---|---|---|
| Treatment group | Female | 11 |
| | Male | 15 |
| | Total | 26 |
| Control group | Female | 14 |
| | Male | 12 |
| | Total | 26 |

## Data Collection

There are various visual perception tests in the literature such as *Bender Gestalt, Goldstein Scheerer* and *Kohs Cubes tests*; however these tests require individual testing administrations and do not offer data based on the age levels. *Frostig Development Test of Visual Perception* was developed by Dr. Marianne Frostig in 1961. *The Frostig Test* could be administered to groups and requires less than one hour for application. *The Frostig Test* have been applied in many countries and cultural groups. It is a commonly preferred instrument in Türkiye based on available validity and reliability measures obtained through previous studies (Akaroğlu, 2014; Akaroğlu & Dereli, 2012; Aral & Bütün Ayhan, 2016).

*The Frostig Development Test of Visual Perception* is designed to assess aspects of visual perception skills in children in order for teachers to be able to address learning needs. The test assesses Hand-eye-motor coordination, Perception of figure-ground, Perception of form constancy, Perception of position in space, and Perception of spatial relationships. Visual perception sub dimension scores are classified and compared according to their perceptual developmental equivalent, and a cumulative score is derived as the visual perception quotient. *The Frostig Development Test of Visual Perception* offered needed consistency, validity and reliability measures and previous data showed that it is an appropriate instrument for the selected age group.

After screening children with learning difficulties for many years, Marianne Frostig observed that these children performed low especially at visual perception-based applications and decided to develop *The Frostig Developmental Visual Perception Program* (Akaroğlu, 2014, p. 123). Later, the *Frostig program* was adapted for visual perception screening of kindergarten and first grade students, and finally it has become a preferred instrument to evaluate visual perception developments of all children (Aral & Bütün Ayhan, 2016, p. 128). The test was revised over the time and Hammill (Hammill, 1993) developed its final version in 1993 as DTVP-2 (Developmental Test of Visual Perception) (Akaroğlu, 2014, p. 123). Application time for the test is about 30-40 minutes and the test can be applied to children between 4 to 8 years old. While it is applied to younger children as one or two kids together or individually, it also can be applied to children between 6-7 years old as larger groups (Akaroğlu, 2014).

*The Frostig Development Test of Visual Perception* gives us opportunity to score data objectively. The cumulative score is calculated by adding up sub scores and then final quotient is analyzed and evaluated based on the age group. Five sub dimensions of the score are as followed (Frostig, Lefever, Whittlesey, 1963):

1. Eye-hand motor coordination,
2. Perception of figure-ground,
3. Perception of form constancy,
4. Perception of position in space,
5. Perception of spatial relationships

### *The frostig developmental visual perception program*

*The Frostig Developmental Visual Perception Training Program* incorporates training activities to contribute to the development in the five visual perception developmental areas. The training program is structured through from simple to the complex tasks. Application process takes at least 14 weeks, and children could be given individual or group tasks once a week. Program activities are supported by pictures and tasks to contribute to the individual visual development sub categories. The training program was applied to the Treatment group one class hour a week for 14 weeks in the art classroom.

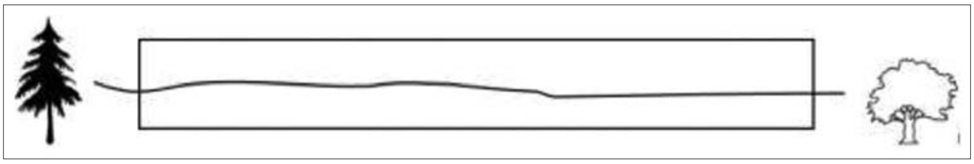

**Figure 1.** Eye-Hand-Motor coordination test example question

The permissions required for the administration of *Frostig Development Test of Visual Perception* was obtained and the researcher went through a training program as part of requirement. Official permissions for application at public schools were obtained through Department of Education.

### Data Analysis and Interpretation

The study aimed to clarify effectiveness of *the Frostig Development Test of Visual Perception and Program* within its perception sub dimensions in relation to participant demographics such as age, gender, parental education attainment and kindergarten education of the children. Individual data evaluation forms were used for both instruments to record data. Scoring of *Frostig Development Test of Visual Perception* sub dimensions and the number of questions in each category differ. The scoring is explained as below:

*Eye-Hand-Motor coordination test* includes 16 questions, the highest possible score for this category is 30 points. Figure 1 shows an example of scoring based on scoring instructions:

The child is instructed to draw an uninterrupted line between the shapes, and the line must go through and between two parallel lines without touching those lines. This section includes tasks of horizontal, vertical, twisted and angled drawings. An uninterrupted line without touching parallel border lines is scored 2 points, a line touching the parallel border lines is scored as 1 point, a line going beyond the parallel borders is scored as 0 point. If the child interrupts the line while drawing he loses points. When the line exceeds the shapes up to 1.3 cm and exceeds the borders, if the line comes short or the line is interrupted, it is scored as 0 point (Aral et al., 2001, p. 200; Aral & Bütün Ayhan, 2016).

Figure 2 is an example of perception of figure-ground test. *Perception of figure-ground test* includes 8 questions from easy to complex with the highest score of 20. This test evaluates children's visual ability to differentiate shapes with backgrounds and overlapping shapes (Aral et al., 2001; Aral & Bütün Ayhan, 2016).

Figure 3 shows an example of perception of form constancy test. *Perception of form constancy test* includes 17 shapes and the highest possible score is 17 points. Circular and oval cards are shown to the children and they are asked: we have a round and an egg shape, find only the round shapes and follow through their contour lines. You must find the round shapes not the egg shapes. When they are done, rectangle and square cards are shown, and they are asked to find only the square shapes (Aral et al., 2001, p. 200; Aral & Bütün Ayhan, 2016).

Figure 4 shows an example of perception of position in space test. *Perception of position in space test* includes finding the exact same shapes as the first shape, the highest possible score is 8. This section includes two sections one is based on finding the same shapes and the other section is finding different shapes (Aral et al., 2001, p. 200; Aral & Bütün Ayhan, 2016).

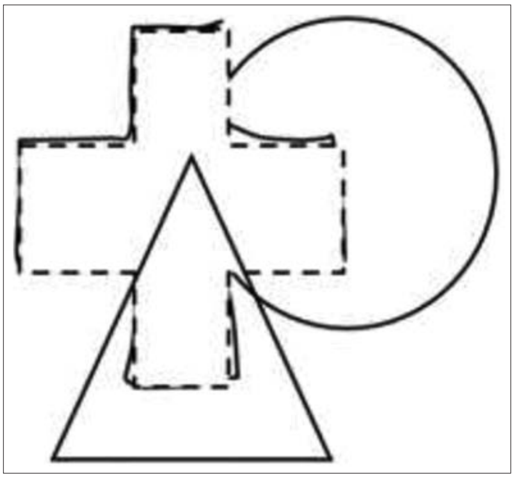

**Figure 2.** Perception of figure-ground test example

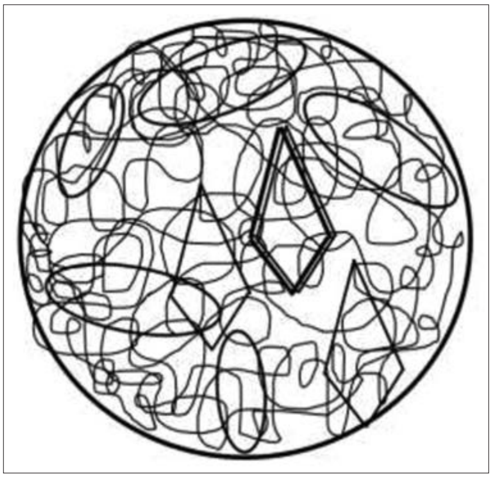

**Figure 3.** Perception of form constancy test example question

Figure 5 shows an example of perception of spatial relationships test. *Perception of spatial relationships test* includes drawing tasks of connecting the dots to draw the exact shapes and the highest possible score is 8. The child is asked to look at a given shape carefully and then draw the exact same shape as connecting the dots.

*Frostig Development Test of Visual Perception* sub-categories require standardized scoring criteria. The raw scores of a child earned for each sub-test correspond to a standardized score. These standardized scores are calculated

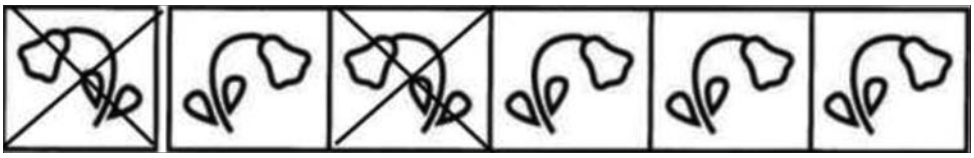

**Figure 4.** Perception of position in space test example question

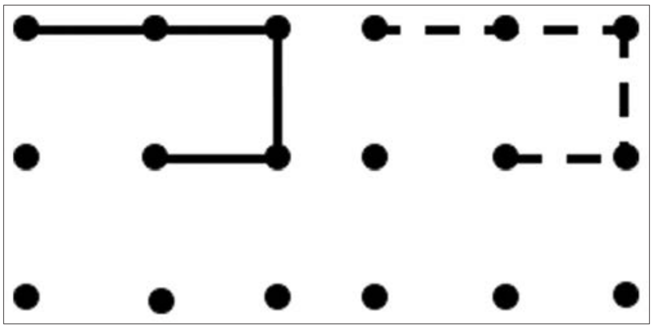

**Figure 5.** Perception of spatial relationships test example question

based on the percentage tables developed for *the Frostig Development Test of Visual Perception.* The standard score in the table is shown as percentile rankings corresponding to the age groups (Aral et al., 2001, p. 200; Aral & Bütün Ayhan, 2016).

### Validity and Reliability

Validity of a research instrument assesses the extent to which the instrument measures what it is designed to measure (Robson, 2011). Content validity, construct validity and criterion validity are mostly used to determine validity of an instrument. Criterion validity (or criterion-related validity) evaluates how accurately a test measures the outcome it was designed to measure. In psychometrics, content validity refers to the extent to which a measure represents all facets of a given construct. Construct validity concerns how well a set of indicators represent or reflect a concept that is not directly measurable.

The instrument, *Frostig Development Test of Visual Perception* has a fragmented structure and consists of five sub-tests. Each sub-test consists of a separate scoring system in the form of 0-1 and 0-1-2 for the age groups of 4-8 years. The corresponding correlation between the scores of the children from sub-tests and the total score of the test is positive and high indicating a high internal consistency of the instrument (Büyüköztürk, 2010; Aral & Bütün Ayhan, 2016).

In 1961, to measure reliability of the instrument, Frostig, Lefever and Whittlesey employed test-retest method to determine internal consistency and reached to a coefficient of 0.98. To determine the validity of the instrument, WISC IQ test verbal section was compared with the sub-test scores of the Frostig test. The comparisons showed correlation scores as followed (Sağol, 1998):

Hand-eye-motor coordination perception scores and WISC: 0.60
Perception of figure-ground and WISC: 0.72
Perception of form constancy and WISC: 0.53
Perception of position in space and WISC: 0.50
Perception of spatial relationships and WISC: 0.75

*Frostig Development Test of Visual Perception* was translated to Turkish and adapted. The Kuder–Richardson (KR-20) formula was used to measure internal consistency reliability of the instrument, findings showed that *Frostig Development Test of Visual Perception Turkish Form* is a useful instrument to be used for 4-8 age groups with consistent validity and reliability measures (Aral & Bütün Ayhan, 2016).

### Limitations

One of the limitations of this study is the difficulties with test administration and training program applications during regular classroom hours. Fortunately, official art curriculum was not an obstacle and it was in accordance with the training program content. Participating student numbers and groups involved in this study were limited with two classrooms. Further studies are suggested as maximizing the number of participants and groups along with the diversified samples of age, gender, and socio-economic demographic variables. Applications of the *Frostig Development Test of Visual Perception and Training Program* in various cities and countries may be beneficial to culminate diverse data so that versatile inferences could be possible and this also may further contribute to validity and reliability measures of the instrument.

## FINDINGS AND INTERPRETATION

The inferences based on the data analysis aimed to clarify whether *the Frostig Visual Perception Training Program* contributed to the visual perception developments of the children in relation to their demographic variables. Table 3 shows the data to compare Treatment and Control groups upon the Pretest administration to the groups.

The Pretest scores of Treatment and Control groups showed no statistically significant difference in visual perception scores [$t(25)=17.818$, $p<.05$]. Figures show that Treatment and Control groups are similar in terms of visual perception scores and it also means that they are suitable samples for this experimental study. Pretest visual perception sub scores of groups are shown in Table 4.

Table 5 shows Pretest and Post-test visual perception sub dimension scores of students in the treatment group. The difference between visual perception sub dimension scores before and after the use of *Frostig Training Program* show statistically significant improvement in the visual perceptions of students. Hand-eye-motor coordination [$t(25)= -12.09$; $p<.05$], Perception of figure-ground [$t(25= -7.215$; $p<.05$], Perception of form constancy [$t(25)= -8.662$; $p<.05$], Perception of position in space [*t*(25)= -6.838; *p*<.05], Perception of spatial relationships [*t*(25)= -7.728; *p*<.05]. The scores showed a significant improvement in all visual perception sub dimensions.

Test scores showed no significant difference based on sex difference. Table 6 shows visual perception sub dimension test scores based on gender. T-tests used to compare group sub category scores in relation to sex. Hand-eye-motor coordination sub category scores between females and males showed no significant difference [*t*(25)= 1.987; *p*<.05], Perception of figure-ground sub category scores between

**Table 3.** Comparison of visual perception pretest scores between groups

| *Groups* | *n* | *M* | *SD* | *Std. Er.* | *t* | *df* | *p* |
|---|---|---|---|---|---|---|---|
| Treatment Group Pretest | 26 | 8.269 | 0.908 | 0.178 | 17.818 | 25 | 0.067 |
| Control Group Pretest | 26 | 8.153 | 0.952 | 0.186 | | | |

**Table 4.** Frostig test of visual perception pretest sub scores of treatment and control groups

| *Visual Perception sub dimensions* | *Groups* | *Test* | *M* | *SD* | *Std. Error* | *t* | *df* | *p* |
|---|---|---|---|---|---|---|---|---|
| Hand-Eye-Motor coordination | Treatment | Pretest | 20.34 | 2.171 | 0.425 | 6.929 | 25 | 0.000 |
| | Control | Pretest | 17.46 | 2.120 | 0.415 | | | |
| Perception of figure-ground | Treatment | Pretest | 6.384 | 2.155 | 0.422 | -1.116 | 25 | 0.275 |
| | Control | Pretest | 6.884 | 2.405 | 0.471 | | | |
| Perception of form constancy | Treatment | Pretest | 8.846 | 2.852 | 0.559 | 4.571 | 25 | 0.000 |
| | Control | Pretest | 7.384 | 2.608 | 0.511 | | | |
| Perception of position in space | Treatment | Pretest | 3.384 | 1.626 | 0.319 | 0.000 | 25 | 1.000 |
| | Control | Pretest | 3.384 | 1.098 | 0.215 | | | |
| Perception of spatial relationships | Treatment | Pretest | 2.384 | 1.235 | 0.242 | 0.796 | 25 | 0.433 |
| | Control | Pretest | 2.153 | 1.541 | 0.302 | | | |

**Table 5.** Frostig test of visual perception pretest and post-test sub scores of treatment group

| *Visual Perception sub dimensions* | *Groups* | *Test* | *n* | *M* | *SD* | *Std. Error* | *t* | *df* | *p* |
|---|---|---|---|---|---|---|---|---|---|
| Hand-Eye-Motor coordination | Treatment | Pretest | 26 | 20.34 | 2.171 | 0.425 | -12.09 | 25 | 0.000 |
| | | Post-test | 26 | 23.34 | 2.152 | 0.422 | | | |
| Perception of figure-ground | Treatment | Pretest | 26 | 6.384 | 2.155 | 0.422 | -7.215 | 25 | 0.000 |
| | | Post-test | 26 | 9.115 | 2.519 | 0.494 | | | |
| Perception of form constancy | Treatment | Pretest | 26 | 8.846 | 2.852 | 0.559 | -8.662 | 25 | 0.000 |
| | | Post-test | 26 | 12.38 | 1.898 | 0.372 | | | |
| Perception of position in space | Treatment | Pretest | 26 | 3.384 | 1.626 | 0.319 | -6.838 | 25 | 0.004 |
| | | Post-test | 26 | 5.230 | 1.106 | 0.217 | | | |
| Perception of spatial relationships | Treatment | Pretest | 26 | 2.384 | 1.235 | 0.242 | -7.728 | 25 | 0.003 |
| | | Post-test | 26 | 4.269 | 1.401 | 0.274 | | | |

**Table 6.** Frostig test of visual perception post-test sub scores of treatment group based on gender

| *Visual Perception Sub Dimensions* | *Sex* | *n* | *M* | *SD* | *Std. Error* | *t* | *p* |
|---|---|---|---|---|---|---|---|
| Hand-Eye-Motor coordination Post-test | Female | 25 | 24.272 | 1.793 | 0.540 | 1.987 | 0.058 |
| | Male | 27 | 22.666 | 2.193 | | | |
| Perception of figure-ground Post-test | Female | 25 | 10.727 | 2.760 | 0.832 | 3.301 | 0.003 |
| | Male | 27 | 7.933 | 1.533 | | | |
| Perception of form constancy Post-test | Female | 25 | 12.909 | 1.044 | 0.314 | 1.218 | 0.235 |
| | Male | 27 | 12.000 | 2.299 | | | |
| Perception of position in space Post-test | Female | 25 | 5.272 | 1.420 | 0.428 | 0.162 | 0.872 |
| | Male | 27 | 5.200 | 0.861 | | | |
| Perception of spatial relationships Post-test | Female | 25 | 4.909 | 1.221 | 0.368 | 0.153 | 0.846 |
| | Male | 27 | 3.800 | 1.373 | | | |

females and males showed no significant difference [*t*(25)= 3.301; *p*<.05], Perception of form constancy sub category scores between females and males showed no significant difference [*t*(25)= 1.218; *p*<.05], Perception of position in space sub category scores between females and males showed no significant difference [*t*(25)=.162; *p*<.05], Perception of spatial relationships sub category scores between females and males showed no significant difference [*t*(25)=.153; *p*<.05], and score comparisons showed no apparent relationship between visual perception scores and gender.

One-way ANOVA test was used to analyze and compare visual perception sub category scores of students in relation to their age levels. The groups included students between the ages of 5-7. Table 7 shows visual perception sub category scores of students based on age groups. Visual perception scores showed statistically significant difference based on age groups in terms of Hand-eye-motor coordination [*F*(2.23)=.377; *p*=.05], Perception of figure-ground [*F*(2.23)=.377; *p*=.05], Perception of form constancy [*F*(2.23)=.377; *p*=.05]. However, the scores showed no significant difference in relation to Perception of position in space [*F*(2.23)=.377; *p*=.05], and Perception of spatial relationships [*F*(2.23)=.377; *p*=.05] sub categories.

Parental involvement in educational processes is a common concern; therefore, parents' educational attainment levels as a contributing factor to children's visual perception was examined. Table 8 shows relationships between students' visual perception scores and their mothers' educational attainment, in those terms the table shows meaningful difference based on some visual perception sub categories. Visual perception test scores showed statistically significant difference based on mother's educational attainment in terms of Hand-eye-motor coordination [*F*(2.23)=.558; *p*=.05], Perception of figure-ground [*F*(2.23)=.462; *p*=.05], Perception of form constancy [*F*(2.23)=.138; *p*=.05], and Perception of position in space [*F*(2. 23)=1.291; *p*=.05]. However, there was no significant relationship between mother's educational attainment and Perception of spatial relationships [*F*(2.23)=3.714; *p*=.05].

Table 9 shows the relationships between students' visual perception scores and their fathers' educational attainment. Visual perception test scores showed statistically significant difference based on father's educational attainment in terms of Hand-eye-motor coordination [*F*(3.23)= 1.053; *p*=.05], Perception of figure-ground [*F*(3.23)= 4.517; *p*=.05], and Perception of form constancy [*F*(3.23)=.596; *p*=.05]. However, there was no significant relationship between father's educational attainment and the sub categories of Perception of position in space [*F*(3.23)=.296; *p*=.05] and Perception of spatial relationships [*F*(3.23)=.546; *p*=.05].

Visual Perception scores of students with and without kindergarten education were a matter of concern since the question of "nature vs. nurture" have been largely debated. In both groups, number of children who previously attended to kindergarten education were much higher; therefore, an exact comparison of the groups was not justifiable. Nevertheless, based on the findings, kindergarten education was a contributing factor to children's visual perceptive developments. As shown in Table 10, 19 students from Treatment group out of 26; and 22 students in Control group out of 26 previously attended kindergarten. Based on t tests of *the Frostig Test Visual Perception* scores of students with and without kindergarten education revealed the following sub test comparisons:

Hand-Eye-Motor coordination sub test: the students at the treatment group without previous kindergarten education scores of *M*=21.71, and with kindergarten education, *M*=23.94. The scores of female and male students within the group showed a meaningful difference [*t*(25)= -2.603, *p*<.05].

Perception of figure-ground sub test: the students at the treatment group without previous kindergarten education

**Table 7.** The Frostig Test Visual Perception sub dimension scores of students based on their age

| *Visual Perception Sub Dimensions* | *Age* | *n* | *SD* | *Group Comparison* | *SS* | *df* | *MS* | *F* | *p* |
|---|---|---|---|---|---|---|---|---|---|
| Hand-Eye-Motor coordination | 5 | 10 | 2.181 | Between | 6.442 | 2 | 3.221 | 0.377 | 0.004 |
| | 6 | 35 | | Within | 109.443 | 23 | 4.758 | | |
| | 7 | 7 | | Total | 115.885 | 25 | | | |
| Perception of figure-ground | 5 | 10 | 2.103 | Between | 56.868 | 2 | 28.434 | 0.425 | 0.006 |
| | 6 | 35 | | Within | 101.786 | 23 | 4.425 | | |
| | 7 | 7 | | Total | 158.654 | 25 | | | |
| Perception of form constancy | 5 | 10 | 1.818 | Between | 14.097 | 2 | 7.048 | 0.331 | 0.000 |
| | 6 | 35 | | Within | 76.057 | 23 | 3.307 | | |
| | 7 | 7 | | Total | 90.154 | 25 | | | |
| Perception of position in space | 5 | 10 | 1.097 | Between | 2.887 | 2 | 1.443 | 1.197 | 0.320 |
| | 6 | 35 | | Within | 27.729 | 23 | 1.206 | | |
| | 7 | 7 | | Total | 30.615 | 25 | | | |
| Perception of spatial relationships | 5 | 10 | 1.334 | Between | 8.130 | 2 | 4.065 | 2.281 | 0.125 |
| | 6 | 35 | | Within | 40.986 | 23 | 1.782 | | |
| | 7 | 7 | | Total | 49.115 | 25 | | | |

**Table 8.** The Frostig Test Visual Perception sub dimension scores of students based on mother's education

| *Visual Perception Sub Dimensions* | *Mother's Educational Attainment* | *n* | *SD* | *Group comparison* | *SS* | *df* | *MS* | *F* | *p* |
|---|---|---|---|---|---|---|---|---|---|
| Hand-Eye-Motor coordination | Elementary | 16 | 1.857 | Between | 39.94 | 2 | 13.316 | 0.558 | 0.003 |
| | Middle Sch. | 15 | | Within | 75.93 | 23 | 3.452 | | |
| | High Sch. | 16 | | Total | 115.88 | 25 | | | |
| | Bachelor's | 5 | | | | | | | |
| Perception of figure-ground | Elementary | 16 | 2.452 | Between | 26.36 | 2 | 8.789 | 0.462 | 0.022 |
| | Middle Sch. | 15 | | Within | 132.28 | 23 | 6.013 | | |
| | High Sch. | 16 | | Total | 158.65 | 25 | | | |
| | Bachelor's | 5 | | | | | | | |
| Perception of form constancy | Elementary | 16 | 1.528 | Between | 38.78 | 2 | 12.930 | 0.138 | 0.005 |
| | Middle Sch. | 15 | | Within | 51.36 | 23 | 2.335 | | |
| | High Sch. | 16 | | Total | 90.15 | 25 | | | |
| | Bachelor's | 5 | | | | | | | |
| Perception of position in space | Elementary | 16 | 1.087 | Between | 4.58 | 2 | 1.528 | 1.291 | 0.302 |
| | Middle Sch. | 15 | | Within | 26.03 | 23 | 1.183 | | |
| | High Sch. | 16 | | Total | 30.61 | 25 | | | |
| | Bachelor's | 5 | | | | | | | |
| Perception of spatial relationships | Elementary | 16 | 1.217 | Between | 16.51 | 2 | 5.504 | 3.714 | 0.027 |
| | Middle Sch. | 15 | | Within | 32.60 | 23 | 1.482 | | |
| | High Sch. | 16 | | Total | 49.11 | 25 | | | |
| | Bachelor's | 5 | | | | | | | |

**Table 9.** The Frostig Test Visual Perception sub dimension scores of students based on father's education

| *Visual Perception Sub Dimensions* | *Father's Educational Attainment* | *n* | *SD* | *Group Comparison* | *SS* | *df* | *MS* | *F* | *p* |
|---|---|---|---|---|---|---|---|---|---|
| Hand-Eye-Motor coordination | Elementary | 10 | 2.028 | Between | 25.349 | 3 | 8.450 | 1.053 | 0.000 |
| | Middle Sch. | 14 | | Within | 90.536 | 23 | 4.115 | | |
| | High Sch. | 22 | | Total | 115.885 | 25 | | | |
| | Bachelor's | 6 | | | | | | | |
| Perception of figure-ground | Elementary | 10 | 2.112 | Between | 60.475 | 3 | 20.158 | 4.517 | 0.013 |
| | Middle Sch. | 14 | | Within | 98.179 | 23 | 4.463 | | |
| | High Sch. | 22 | | Total | 158.654 | 25 | | | |
| | Bachelor's | 6 | | | | | | | |
| Perception of form constancy | Elementary | 10 | 1.628 | Between | 31.797 | 3 | 10.599 | 0.596 | 0.002 |
| | Middle Sch. | 14 | | Within | 58.357 | 23 | 2.653 | | |
| | High Sch. | 22 | | Total | 90.154 | 25 | | | |
| | Bachelor's | 6 | | | | | | | |
| Perception of position in space | Elementary | 10 | 1.156 | Between | 1.187 | 3 | 0.396 | 0.296 | 0.828 |
| | Middle Sch. | 14 | | Within | 29.429 | 23 | 1.338 | | |
| | High Sch. | 22 | | Total | 30.615 | 25 | | | |
| | Bachelor's | 6 | | | | | | | |
| Perception of spatial relationships | Elementary | 10 | 1.441 | Between | 3.401 | 3 | 1.134 | 0.546 | 656 |
| | Middle Sch. | 14 | | Within | 45.714 | 23 | 2.078 | | |
| | High Sch. | 22 | | Total | 49.115 | 25 | | | |
| | Bachelor's | 6 | | | | | | | |

scores of *M*=7.42, and with kindergarten education, *M*=9.73. There was no meaningful difference observed between the groups [*t*(25)= -2.813; *p*<.05].

Perception of form constancy sub test: the students at the treatment group without previous kindergarten education scores of *M*=10.857, and with kindergarten education, *M*=12.947. There was meaningful difference observed between the groups [*t*(25)= -2.813; *p*<.05].

Perception of position in space sub test: the students at the treatment group without previous kindergarten education scores of *M*=4.85, and with kindergarten education, *M*=5.36. There was no meaningful difference observed between the groups [*t*(25)= -1.047; *p*<.05].

Perception of spatial relationships sub test: the students at the treatment group without previous kindergarten education scores of *M*=3.57, and with kindergarten education, *M*=4.52. There was no meaningful difference observed between the groups [*t*(25)= -1.852; *p*<.05].

One-way ANOVA test was used to analyze and compare visual perception sub category scores of students in relation to their family income levels. As shown in Table 11, visual perception test scores showed no statistically meaningful difference based on family income levels in terms of hand-eye-motor coordination [*F*(2.23)= 3.570; *p*=.05], perception of form constancy [*F*(2.23)= 3.220; *p*=.05], perception of position in space [*F*(3.23)=.839; *p*=.05], and perception of spatial relationships [*F*(3.23)= 1.769; *p*=.05] sub categories. However, ANOVA test scores showed meaningful difference between perception of figure-ground sub test scores and family income levels [*F*(2.23)= 2.277; *p*=.05],

By the end of the training program, both groups were administered Post-tests and Table 12 shows group comparisons. Treatment group Post-test scores (*M*=10.86) and the control group Post-test scores (*M*=9.19), showed a significant difference between groups [*t*(25)= -12.208; *p*<.05)]. Table 13 shows visual perception sub-test scores of both groups:

As an experimental study static group comparison, the first phase of this study included screening and selection of sample groups to determine visual perception developmental levels of treatment and control groups. Both sample groups were selected as similar groups representing typical homogenous characteristics of first graders. Findings showed that

**Table 10.** Comparison of the Frostig Test sub dimension scores of students with and without kindergarten education

| *Visual Perception Sub Dimensions* | *Kindergarten Education* | *n* | *M* | *SD* | *Std. Error* | *t* | *p* |
|---|---|---|---|---|---|---|---|
| Hand-Eye-Motor coordination | No | 11 | 21.714 | 1.799 | 0.680 | -2.603 | 0.016 |
| | Yes | 41 | 23.947 | 1.985 | 0.455 | | |
| Perception of figure-ground | No | 11 | 7.428 | 1.397 | 0.528 | -2.911 | 0.009 |
| | Yes | 41 | 9.736 | 2.578 | 0.591 | | |
| Perception of form constancy | No | 11 | 10.857 | 1.676 | 0.633 | -2.813 | 0.010 |
| | Yes | 41 | 12.947 | 1.682 | 0.385 | | |
| Perception of position in space | No | 11 | 4.857 | 0.690 | 0.260 | -1.047 | 0.306 |
| | Yes | 41 | 5.368 | 1.211 | 0.277 | | |
| Perception of spatial relationships | No | 11 | 3.571 | 1.618 | 0.611 | -1.852 | 0.125 |
| | Yes | 41 | 4.526 | 1.263 | 0.289 | | |

**Table 11.** Comparison of the Frostig Test sub dimension scores of students based on family income

| *Visual Perception Sub Dimensions* | *Family income* | *N* | *SD* | *Group comparison* | *SS* | *df* | *MS* | *F* | *p* |
|---|---|---|---|---|---|---|---|---|---|
| Hand-Eye-Motor coordination | Low | 15 | 1.960 | Between | 27.451 | 2 | 13.726 | 3.570 | 0.045 |
| | Average | 24 | | Within | 88.433 | 23 | 3.845 | | |
| | High | 13 | | Total | 115.885 | 25 | | | |
| Perception of figure-ground | Low | 15 | 2.399 | Between | 26.221 | 2 | 13.110 | 2.277 | 0.125 |
| | Average | 24 | | Within | 132.433 | 23 | 5.758 | | |
| | High | 13 | | Total | 158.654 | 25 | | | |
| Perception of form constancy | Low | 15 | 1.749 | Between | 19.721 | 2 | 9.860 | 3.220 | 0.058 |
| | Average | 24 | | Within | 70.433 | 23 | 3.062 | | |
| | High | 13 | | Total | 90.154 | 25 | | | |
| Perception of position in space | Low | 15 | 1.113 | Between | 2.082 | 2 | 1.041 | 0.839 | 0.445 |
| | Average | 24 | | Within | 28.533 | 23 | 1.241 | | |
| | High | 13 | | Total | 30.615 | 25 | | | |
| Perception of spatial relationships | Low | 15 | 1.360 | Between | 6.549 | 2 | 3.274 | 1.769 | 0.193 |
| | Average | 24 | | Within | 42.567 | 23 | 1.851 | | |
| | High | 13 | | Total | 49.115 | 25 | | | |

**Table 12.** The Frostig Test of Visual Perception Post-test comparisons between treatment and control groups

| *Groups* | *N* | *M* | *SD* | *Std. Error* | *t* | *df* | *p* |
|---|---|---|---|---|---|---|---|
| Treatment Group Post-test | 26 | 10.869 | 0.954 | 0.187 | -12.208 | 25 | 0.000 |
| Control Group Post-test | 26 | 9.192 | 0.982 | 0.192 | | | |

**Table 13.** The Frostig Test sub-category scores and Post-test comparisons between treatment and control groups

| *Visual Perception Sub Dimensions* | *Groups* | *Test Türü* | *M* | *SD* | *Std. Error* | *t* | *df* | *p* |
|---|---|---|---|---|---|---|---|---|
| Hand-Eye-Motor coordination | Treatment | Post-test | 23.346 | 2.152 | 0.422 | 4.909 | 25 | 0.120 |
| | Control | Post-test | 20.615 | 2.639 | 0.415 | | | |
| Perception of figure-ground | Treatment | Post-test | 9.115 | 2.519 | 0.494 | 3.361 | 25 | 0.011 |
| | Control | Post-test | 7.500 | 2.319 | 0.471 | | | |
| Perception of form constancy | Treatment | Post-test | 12.384 | 1.898 | 0.372 | 5.145 | 25 | 0.000 |
| | Control | Post-test | 10.923 | 2.225 | 0.511 | | | |
| Perception of position in space | Treatment | Post-test | 5.230 | 1.106 | 0.217 | 6.274 | 25 | 0.242 |
| | Control | Post-test | 3.346 | 1.354 | 0.215 | | | |
| Perception of spatial relationships | Treatment | Post-test | 4.269 | 1.401 | 0.274 | 3.493 | 25 | 0.000 |
| | Control | Post-test | 3.576 | 1.527 | 0.302 | | | |

visual perception test scores of Treatment group after *Frostig Visual Perception Training Program* was significantly higher when compared to their Pretest scores. When we examined the visual perception sub test scores, Hand-Eye-Motor coordination, Perception of figure-ground, Perception of form constancy, Perception of position in space, and Perception of spatial relationships sub dimension scores showed meaningful differences.

As shown in Table 13, Hand-eye-motor coordination Post-test mean score of Treatment group is *M*=23.34, Post-test mean score of control group is *M*=20.61; Perception of figure-ground Post-test mean score of Treatment group is *M*=9.11, Post-test mean score of control group is *M*=7.50; Perception of position in space Post-test mean score of Treatment group is *M*=5.23, Post-test mean score of control group is *M*=3.34. As shown in the table there was no meaningful difference between treatment and control groups when Hand-eye-motor coordination [$t(25)= 4.909$; $p<.05$], Perception of figure-ground [$t(25)=3.361$; $p<.05$], and Perception of position in space [$t(25)= 6.274$; $p<.05$] sub test scores were compared. On the other hand, Perception of form constancy Post-test mean score of Treatment group is *M*=12.38, Post-test mean score of Control group is *M*= 2.22; Perception of spatial relationships Post-test mean score of Treatment group is *M*=4.26, while Post-test mean score of Control group is *M*= 3.57. Accordingly, there was statistically meaningful difference between Treatment and Control groups when Perception of form constancy [$t(25)=5.14$; $p<.05$], and Perception of spatial relationships [$t(25)=3.49$; $p<.05$] sub test scores were compared.

## DISCUSSION

Visual perception skills acquired during early childhood help children to develop problem solving abilities, support creative thinking, and help them to structure reasoning skills. All those skills are manifold and help developmental processes as a whole (Karaaslan & Şahin, 2006). When we consider visual perception processes, cognitive and emotional developmental realm, art education curriculum along with daily art activities are all contributors at some extent. This study evaluated visual perceptive problems of children along with means to develop and support visual perceptive skills at early stages of their lives. These visual perceptive skills are also closely connected with the development of reading and writing skills.

Visual perception could be defined as a set of skills and can be developed through certain interventions. Expecting visual perception to progress and mature itself over time without any training or educational interventions is ineffectual. Educational interventions should be developed and used to support this developmental process and to help children fulfill their own potentials since visual perception also affects other developmental areas. Children's visual perceptive readiness develops much earlier and prepares children for reading and writing. Supporting children's visual perception development and perceptive potentials will probably help their learning in their educational lives at a great extent. Consequentially, visual perception developments of children should be monitored throughout their early developmental stages as similar to other areas of development. Visual perception should not be considered as part of only artistic development or art education since it clearly affects children's developments and skill sets in many aspects of their developments.

Visual perception is the biggest contributor and a fundamental dimension of perception as a whole. Early identification of visual perception problems is very crucial to deal with possible challenges individuals may encounter in their later lives. Therefore, visual perception tests such as *Frostig*

*Test* may be suggested to use more often or at least similar identification instruments may be adapted to use in the art classroom. Early identification of visual perception problems may be seen as a preventative, pro-literacy approach and may be further helpful for the special education needs. As suggested in this study, visual perception training is not only for children with visual perception issues but it also helps accelerated visual perception development of a typical school age children. Visual perception training may be suggested to be a part of art curriculum, and lessons and strategies could be designed in alignment with visual perception development of the various grade levels. Visual perception is a general term which is more or less associated with various perceptive skills and developmental abilities including abilities of other developmental areas. Cognitive development, motor development and emotional development areas are monitored during childhood. Learning and literacy skills are also closely related with these areas of development. It should be emphasized that visual perception development is also a part of child's sensory development, and it plays a fundamental role for the development in all other areas as well.

The results of this study are consistent with previous studies conducted with the *Frostig Test of Visual Perception* (Akaroğlu, 2014; Koç, 2002; Aral et al., 2001). It was reported that art education curriculum was short of content to support visual perception skills (Akkurt & Boratav, 2018). Harmankaya (2010) studied visual perception skills of first graders in relation to their reading-writing experiences within the variables of gender, age, reading habits and school success. He found meaningful relationships with all variables except gender. In their study, Aral and Erturan (1999) used *Frostig Visual Perception Training Program* for 4 to 8-year-old children and found effectiveness of the training program on children's visual perceptive skills. They also found that mother's educational attainment contributed to the children's visual perception developments. Similarly, Arıkök (2001) also found positive relationship between mother's educational attainment and the visual perception scores of children. Bayhan (1992) reported that children with lower visual perception scores more likely had mothers with lower level educational attainment. Father's education was also a contributing factor and similar results were reported about the fathers' educational attainments in relation to children's visual perceptive abilities (Bayhan, 1992; Arıkök, 2001).

Kindergarten education may be contributing factor to children's visual perceptive developments. However, in the current study, the number of students who previously attended to kindergarten education were proportionally much higher in both groups; therefore, a valid conclusion may not be justifiable. In a study it was indicated that children who went through a visual perception training during their kindergarten education were more successful in their reading skills (Linn, 1968). Similarly, another study reported that students who went through *Frostig Visual Training Program* were more successful in their later school lives (Çağatay & Mangır, 1990).

Depending on the studied phenomenon, family income may be a contributing factor in educational research. Current findings showed no direct relationship with family income in most visual perception sub skills but Perception of figure-ground sub test scores were positively correlated.

The study concluded that *Frostig Visual Perception Training Program* contributed to the students' visual perceptive abilities in general while there was no meaningful contribution in some sub dimensions of visual perception. Findings were consistent with previous research (Bezrukikh & Terebova, 2009; Aral et al., 2001). While Treatment group showed an improvement during training program, Control group did not show such improvement meaning that regular art curriculum did not contribute to their visual perception skills specifically (Dilmaç & İnal, 2020). Adjusting standard art curriculum according to *the Frostig Training Program* content may be beneficial for other grade levels as well. Such an approach is suggested to help with children with putting ideas and imagination into practice, and experiencing creative problem-solving opportunities (Artut, 2013).

Art education serves to various objectives such as supporting creativity and artistic talent development, teaching problem solving skills, supporting self-assurance and self-esteem, teaching visual literacy skills, supporting aesthetic sensitivity and development (Dikici, 2006; Aykut, 2006). Another objective is to teach problem solving skills by means of teaching reasoning and creative thinking so that students may become happy, content, accommodating, and environmentally sensitive individuals (Yolcu, 2009). Creative self-expression is another contribution to students' communication skills and well beings, through art making process students also gain self-discipline and learn responsibility.

Children express themselves through art in early stages, while they observe and get familiar with their surroundings, they try to prove themselves as a unique identity through their drawings (Artut, 2013). Art education helps children learn through observation and experience. They express themselves and their emotions, develop skills to command over various media, and finally build skills to understand, analyze, evaluate and appreciate art works (Özsoy, 2007).

Researchers suggested that children should be provided richer stimuli to avoid difficulties in school and their daily lives to support needed background while visual perception development is still in progress (Aral, 2010; Ercan, 2009). Children who are ready for visual processing of letters are also progressively ready to direct their gaze toward details of events, objects and associations between parts and whole (Arıkök, 2001, p. 89). Students are expected to make progress in their perceptive skills, aesthetic sensitivities, and self-expressive abilities through the stages of art education. It is obvious that children with visual perception problems are likely to encounter challenges in their lives; therefore, these visual perceptive problems should be identified earlier to find needed solutions (Cengiz, 2002, p. 102). There are very limited number of studies in the literature about visual perception and related problems. Therefore, it is very difficult to make factual inferences to adapt strategies for art classrooms. Researchers often indicated that children should be identified earlier and interventions should be developed to prevent possible psychological and academic problems. For instance, visual perception problems of first graders cause reading and writing difficulties (Akaroğlu & Dereli, 2012; Erben, 2005). Visual perception training and art education are crucial for students to become confident and productive critical thinkers (Dilmaç & İnal, 2020). Based on the results, we could conclude that art curriculum should be designed to support visual perception development, art education objectives should be reconsidered accordingly and classroom practices should be developed based on students' visual perceptive developmental needs and interests.

## CONCLUSION

By the end of the training program, there was significant difference between the Post-test scores of the Treatment group and the Control group. Therefore, we can conclude that *Frostig Visual Perception Training Program* contributed to students' visual perceptive developments when administered as part of a regular art classroom. However, when visual perception sub dimensions were considered, there was no meaningful difference between treatment and control groups in relation to Hand-Eye-Motor coordination, Perception of figure-ground, and Perception of position in space sub test scores were compared. On the other hand, there was statistically meaningful difference between Treatment and Control groups when Perception of form constancy and Perception of spatial relationships sub test scores were compared.

Although Frostig Visual Perception Training Program consists of various tasks and practices to help with visual perceptive development, these tasks seem rather limited; therefore, they could also be extended well beyond these tasks in the art classrooms. The concept of visual perception is not an unfamiliar term for art teachers, perhaps it could be discussed with art education professionals to develop useful and efficient dimensions of visual perception to help with classroom strategies and with development of new instruments. Art should not be seen as an autonomous course beyond curriculum, art classes may play a major role in visual perception development especially at earlier ages and may help with early literacy skills at a great extent. Art curriculum may further be developed, designed and revised to support learning and development of early literacy skills of children through early childhood and primary grades.

Increasingly intense use of visual stimuli in today's violently technology-oriented world is much more demanding on our visual senses. Over demanding use of visual stimuli on our eyes causes apathy and insensitivity after a while. Visual relaxation exercises or visual meditation practices may be some new interventions we could face with very soon. Art education in general clearly needs to orient itself in alignment with the intense use of visual images along with the technology. Art education curriculum typically consists of teaching aesthetics, art history, art criticism and art making practices; visual perception training, aesthetic sensitivity training and visual meditation may be suggested as new areas of art education based on changing needs.

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