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Visual Perception in Specific Learning Difficulties

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ABSTRACT

From the moment the child is born, learning becomes meaningful and it is interpreted as a result of the experiences first in the family and then in school. However, it is sometimes not possible to talk about the fact that learning takes place in all children although the process has taken place in this direction. Sometimes the individual differences that exist in children and the inability to get the necessary support in structuring their learning experiences can be effective in the failure of learning, while sometimes the type of congenital difficulty can be effective. One of these types of difficulty is a specific learning difficulty. It is not always possible for children with specific learning difficulties to learn, even if they do not have any mental problems. In this case, many factors can be effective, especially the problems that children experience in their visual perception can become effective. Since visual perception is the processing of symbols received from the environment in the brain, the problem that may be experienced in this process can also make it difficult to learn this situation. In line with these considerations, it is aimed to focus on the importance of visual perception in specific learning difficulties.

KEYWORDS

Learning; specific learning difficulty; perception; visual perception; child.

INTRODUCTION

Learning is an individual's effort to make sense of the world. In other words, learning can be defined as all of the permanent changes that occur in the behavior of the individual as a result of the interaction and communication with the environment (Kocayörük & Çelik, 2017). Learning generally takes place by going through certain stages, and at the end of the term, all children acquire experiences that are meaningful to them and that can bring about a change in their behavior. However, sometimes learning may not occur due to some reasons although the situation is in this direction. The underlying reasons for this situation can be considered as the inadequacy of learning with the individual and developmental characteristics of the child, the problems experienced in perception, and the special situation of the child (Aral, 2021).

Human beings receive many stimuli and stimulations around them at every moment. These stimuli are processed in the brain and can form a meaningful whole. Thus, information stacks received from the environment can be transformed into meaningful information by subjecting them to the perception process. Making the information stacks available in centers such as visual perception and auditory perception constitutes the perception dimension of learning (Bee & Boyd, 2009). Thanks to these perceptions, the brain gives orders to the necessary centers and ensures the formation of learning. Although learning usually takes place as a result of this perception and processing, any problem that may occur in these centers is one of the important obstacles to learning. As a result of individuals having a problem, learning cannot take place or it may take place incorrectly (Aral, 2010; 2021; Aral & Sağlam, 2016; Aral & Yücelyiğit, 2014; Doğan, 2018). This situation can create a specific learning difficulty.

Specific learning difficulty is considered as a functional disorder that is determined by genetic or environmental factors and has a biological basis (Siegel, 2007). Although children with specific learning difficulties have normal or above-normal abilities, they have problems in learning due to the problems they experience in perception, and these problems can lead to different problems, isolation, or stigmatization. Although children with specific learning difficulties have normal or above-normal abilities, they have problems in learning due to the problems they experience in perception, and these problems can lead to different problems, isolation, or stigmatization (Alexander & Slinger, 2004; Doğan, 2018; Elemek, 2008; Korkmazlar & Sürücü, 2007; Kurdoğlu, 2001; Snowling, 2005). However, it is clear that it is very important to provide education services for all children's characteristics. Based on this importance, firstly, the concept of learning will be discussed and explained, and then researches and suggestions will be given to support specific learning difficulty, perception, visual perception, and visual perception in specific learning difficulty.

WHAT IS LEARNING?

In learning; it is important that there is an observable change in behavior, and it is expected that the change in behavior will be relatively continuous and will be gained as a result of experience.

Behavioral changes that occur temporarily due to factors such as fatigue, illness, taking medication and that only occur after growth cannot be considered as learning products (Senemoğlu, 2013). As can be seen in the statement made, learning begins with the birth of the child, develops as one communicates with the environment, and constitutes an important part of development. As a result of learning, changes begin to occur in behaviors, and these experiences leave permanent traces in the life of the individual and become her/his identity (Oktay, 2018). Learning, which is very important, takes place in several stages.

In learning, first, it is important that the person who is in the position of learner pays attention. In this context, the individual, who receives the necessary information from the many stimuli in the environment by using the attention mechanism, first sends what s/he receives to the processing center of the brain, where the information is subjected to the perception mechanism. In perception, different parts of the brain can function in different areas. Thus, the brain transforms the information that comes to it into meaningful information and forms the infrastructure that is important in learning (Keleş & Çepni, 2006). In this context, perception, and especially visual perception, which is one of the types of perception, is very important in terms of the realization of learning, and its features are given below.

PERCEPTION AND VISUAL PERCEPTION

Perception is the process of making sense of the information received from the environment. Perception, which is a cognitive process, is the interpretation of information coming from the external environment to the sense organs. The purpose of perception is to enable the learner to configure the symbol systems in the outside world by using appropriate cognitive processes (Erdemir, 1999; Frostig & Maslow, 1973).

The right and left hemispheres of the brain play an active role in perception. It is emphasized that the information coming to the right hemisphere of the brain manages non-verbal functions; therefore, the processing of imagination, color, music, shape, color, and schemes and the use of intuition are more intense. In the left hemisphere, it is stated that functions such as mathematics, writing, language processing, classification of ideas, verbal and logical functions are organized (Demirel, 2013; Gülpınar, 2005; Özden, 2003). In this context, problems in nonverbal functions may arise as a result of problems that may occur in the right hemisphere of the brain, and problems in the performance of reading, mathematics, and written operations may be encountered in problems that occur in the left hemisphere (Keleş & Çepni, 2006). In addition to these problems, problems that may arise during the general processing of information in the brain may cause problems in learning (Aral, 2010; Doğan, 2018). One of the problems expressed is the problems experienced in visual perception.

Visual perception is the ability to convert visual information from the environment into symbols and actions by using the necessary mechanisms of the brain. In this process, the photons (parts representing the type of light and radiation) reflected from the shapes, colors, signs, events, or objects that the individual receives through vision from the environment are

first reflected on the retina layer of the eye. These meaningless shapes, which are reflected on the retina layer, are sent to the necessary regions of the brain and subjected to analysis and synthesis processes. After the analysis and synthesis processes, objects that are only a meaningless crowd of shapes or pictures at the beginning turn into meaningful information with visual perception processes (Bulduk, 2014; Çakır, 2014).

Visual perception is very important in the lives of children and then all people. As a matter of fact, thanks to the three-dimensional shapes perceived by visual perception, it is possible to accurately estimate the location and distance in the space and, in parallel, to be protected from accidents (Ahmetoğlu et al., 2008; Kurtz, 2006). At the same time, through visual perception, meaningless text piles become words, reading and writing operations can be performed, and numbers become usable in mathematical operations. These situations also help one's academic success, being successful in society, and paving the way for self-realization (Aral, 2010; Bezrukikh & Terebova, 2009; Bütün-Ayhan et al., 2015; Gabbard, 2008).

Visual perception proceeds in several processes. Although newborns look around for a short time, they only perceive the image of objects that are within two meters of them, and cannot perceive the others fully yet. In this period, vision in the perception of the newborn can occur at close distances and in short periods (Berk, 2013). However, the important point in visual perception is that the information around is taken with the sense of sight and subjected to the necessary processes. Therefore, under this point of view, it is possible to say that the visual perception of newborns is still in the development stage (Kellman & Arterberry, 2006).

The newborn structures his/her sight depending on the developmental stages. The baby, who first gains the ability to look at the objects around his/her for longer periods, can also see longer distances. In parallel with the baby's eyesight, especially with the help of the development of crawling motor behaviors, the perception of depth becomes shaped. The depth and visual perception, which are primitive in the beginning and open to the direction of adults, progress in parallel with development, and become quite successful when the baby passes the first childhood period. In connection with the success achieved, the baby is now able to perform motor skills such as walking alone, climbing stairs, performing self-care skills, meeting with a pencil, drawing shapes. All these can help the baby to understand that s/he is a different individual from her environment and to realize his/her developmental characteristics (Aral & Sağlam, 2016; Berk, 2013; Yücelyiğit & Aral, 2016).

Visual perception, depth perception, and pattern perception, which are very primitive in the newborn period and realized in certain stages and places, show progress over time, helping the child to become a competent child in all areas and a competent individual in the future. However, although the situation is in this direction, sometimes the process stated here does not take place in this direction in all children, and children's visual perception problems may affect their learning abilities in the first place, their academic success in the later period, and their social-emotional development areas. Children with specific learning difficulty diagnosis are

among these children and the problems experienced by these children in visual perception can lead to negative consequences in their whole life if they are not intervened (Doğan, 2018).

SPECIFIC LEARNING DIFFICULTY

Specific learning difficulty is considered as the most common situation among learning problems. It is stated that although individuals with specific learning difficulties have normal and/or above-normal intelligence (IQ>85), they cannot successfully fulfill their learning processes (Siegel, 2007). Although the intelligence levels of these children are normal or above normal, it is also seen that their reading is quite slow and full of errors. Moreover, this is not the case for every child or individual with a specific learning difficulty, and there are individual differences. For example, some individuals make mistakes during phonological processing (changing sounds) for reading difficulties, while others have problems with spelling or rapid visual-verbal response (Skiada et al., 2014).

It is stated that such problems experienced in specific learning difficulties are closely related to the problems experienced in the visual perception process. During visual perception, the information received by the sense of sight first reaches the cerebral cortex part of the brain to be processed. As a result of structural disorders in the cerebral cortex, the senses received cannot be perceived in a healthy way (Aral, 2010; Farroni & Menon, 2008).

It is stated that the brain structures of children with specific learning difficulties are different from those of children with normal development (Arı, 2018; Harwell, 2008). As a result of their research, Peng and Funchs (2016) stated that children with specific learning difficulties have problems in the structures of the central nervous system, these problems are the inadequacy of the elements that make up the central nervous system, and as a result of this inadequacy, damage occurs in working memory. These studies on specific learning difficulties also show that the factors that cause specific learning difficulties are a problem with a biological basis that can arise with genetic or environmental factors (Siegel, 2007).

Since children with specific learning difficulties are misidentified and even stigmatized, learning cannot take place or different problems may arise. For this reason, since it is important to recognize the symptoms in the early period, the characteristics of children are limited to pre-school and school periods (Salman et al., 2016):

Characteristics of Children with Specific Learning Difficulties in Preschool Period

- There may be delays in children's speech or errors during speech.
- Sounds that are close to each other can be mixed.
- There is no obvious hand selection, s/he uses both hands equally.
- They often confuse right-left concepts after learning.
- They fail while learning letters and sounds in the alphabet.
- They often confuse or cannot learn the concepts of time and direction.

Characteristics of Children with Specific Learning Difficulties in School Period

- They learn to read quite late and difficultly.
- They often make mistakes even after they learn to read.
- Reading speed is quite slow and full of errors.
- Mixing letters or spelling errors are encountered in writing.
- There are errors in skills such as understanding mathematical concepts, counting, and ordering.
- They confuse similar letters (For example, p and b, d and b).
- They read by mixing letters as well as making mistakes and they jump in reading.
- They may confuse the places of letters while writing.
- They write words that are similar to each other by confusing them.
- While writing, mirror image, and reverse writing features are seen.
- Some of the words may be spelled incorrectly or read incorrectly.
- In oral readings, they can make either a monotonous reading or a bumpy reading.
- Speech and language problems are seen, they lack self-confidence.
- The pages of the notebook are used irregularly, and planning and organizational errors are frequently encountered.
- They have problems in writing round and straight-lined letters or they cannot write.
- Distraction or forgetting may occur.
- They can be extremely active as well as extremely still and inactive.
- They write late and slowly; they cannot accurately copy what is written on the board.
- Quite low success is seen in written exams compared to a learning level.
- Figures, symbols, signs are written by perceiving them backwards.
- Problems in visual and auditory perception and problems in motor coordination are seen.
- They have problems with time.
- They cannot bring the end of the sentences formed. Therefore, they make short sentences.
- They fail in situations that require multiple operations at the same time.
- They cannot perceive abstract concepts.
- They cannot organize, plan, analyze and synthesize.
- They often experience adaptation problems.

When the characteristics of children with specific learning difficulties are examined, it is seen that they generally have problems in visual perception. In this context, especially in recent years, studies have been conducted on the visual perceptions of these children in order to support their developmental areas, especially their learning, and successful results have been obtained.

TYPES OF SPECIFIC LEARNING DIFFICULTY

Specific learning difficulties affect the learning process in different areas. These areas are briefly described below.

Writing Difficulty (Dysgraphia)

Writing difficulty, which is among the specific learning difficulties, is a frequently encountered situation. Writing is not only an important factor in ensuring the academic success of the child (Vinter & Chartrel, 2008) but also has an important place in self-expression (Feder & Majnemer, 2007). Writing difficulty is defined as the situation in which the child has difficulty in writing activities, despite the developmental mental abilities and learning levels of the child are appropriate (Deniz & Erözkan, 2008). In DSM V (2013), it is stated that children with writing difficulties often make significant mistakes in spelling/writing accuracy, grammar, and punctuation use. Therefore, there is a fluency problem in written expression depending on these mistakes made by the children.

Children with writing difficulties often write half words, skip some letters in a text, leave irregular spaces between words and letters in their writing, try to write with irregular wrist positions, and make planning mistakes in the use of space on paper. Children's hand-eye coordination is not developed and their hand preferences are not dominant, so their writing is bad and illegible. Children cannot express themselves in writing, and it is seen that they often make spelling mistakes and punctuation mistakes when they are expected to write. The characteristic errors seen in the writings of these children are quite a lot in the selection of lowercase and uppercase letters, punctuation marks, and syllable divisions. Since the writings of children with writing difficulties are bad, incomprehensible, and far from known rules, especially parents and teachers may react negatively to the writings of these children, and as a result of these reactions, there are serious problems in children's interest and motivation towards writing (Engel-Yeger et al., 2009).

There are significant problems in visual perception in writing difficulties, and the difficulties that children experience in visual perception prevent them from expressing themselves in writing. From this point of view, it is known that one of the underlying causes of the child's writing difficulty is a problem in visual perception (Goldstand et al., 2005; Longcamp et al., 2003). In addition to the problems experienced in visual perception, it is known that these children also have problems in their visual motor abilities. As a result of these errors in visual perception and visual motor skills, it has been determined that children confuse similar letters (such as d instead of b), fail to copy, move their eyes with the feeling of constantly scratching, need to close one eye while working, yawn, and often lose the place where they read. (Doğan, 2018). Therefore, it is possible to prevent the child's writing disorder by eliminating the problems in the child's visual perception.

Poon et al. (2010) applied the program they developed to increase the visual perception of children with writing difficulties. In the study conducted with 26 primary school children in

China, they divided the children into experimental and control groups. The children in the experimental group benefited from eight sessions of computer-assisted visual perception and visual-motor integration programs both at home and at school. As a result of the research, the children in the experimental group showed significant improvements in both the quality and the time of the writing. Leung et al. (2016) applied a motor training program to improve the visual perceptions of children with writing difficulties and specific learning difficulties. As a result of the research, it was concluded that the children made significant progress in their writing control after the implementation of the education program.

Reading Difficulty (Dyslexia)

Dyslexia, first described by W. Pringle Morgan in 1896, is the most common group of specific learning difficulties. In dyslexia, reading failure is seen as incompatible with the child's reading success and mental abilities. These children usually skip letters, read backwards, or confuse words while performing reading activities (Alkan, 2008; Deniz & Erözkan, 2008). In this context, it is necessary to eliminate the underlying cause of children's ability to cope with reading difficulties, in other words, it is necessary to ensure success in reading by transferring the problems they experience in visual perception to other perception areas. It is emphasized that children with dyslexia experience problems in visual perception (Rodrigues et al., 2017).

Dyslexia is divided into developmental dyslexia and acquired dyslexia. Although there is no brain damage in developmental dyslexia, difficulties in reading activities are mentioned from the very early stages (Ercan, 2001). In the acquired dyslexia, while there is no problem with reading due to brain damage at the beginning, difficulties with reading are emphasized due to the brain damage (Sarıpınar, 2006).

Mispronunciation of words, inability to acquire words or have vocabulary very difficultly, difficulty in distinguishing different sounds in words, inability to learn the sounds of letters no matter how hard they try, inability to read correctly because they change the place of letters while spelling or reading, and both aloud and silent reading errors as they cannot perform the reading function are observed in children due to problems in visual perception in reading difficulties. All these mentioned situations may result in stigmatization of children as lazy or in different categories and may result in the failure of learning function due to failure in reading, which eventually becomes a vicious circle (Ataman & Kahveci, 2009; Güzel- Özmen, 2008). As a matter of fact, studies in this field show that children gain a certain quality in reading when perception is structured in different ways.

Magnan and Ecalle (2006) conducted a study to determine the effects of the computer-aided education program that they developed for children with reading difficulties and strengthens visual perception on children's reading skills. The children in the experimental group were implemented a computer-aided education program for five weeks, four days a week, and each session lasted twenty minutes. The children in the control group did not receive any education, and the children continued their education with the traditional education

method. As a result of the research, it was determined that the phonological awareness levels of the children in the experimental group increased.

Skiada et al. (2014) developed software called “Easylexia” for children with reading and mathematics difficulties among children with specific learning difficulties. As a result of the research carried out with five children, it was determined that the children were able to concentrate, focus and successfully perform the tasks given on the computer.

Karakaya and Altuntaş (2017) prepared and implemented occupational therapy intervention programs for children with dyslexia to support their visual perceptions. In the research with two children, studies were carried out to improve visual memory, shape-ground perception, visual discrimination, visual completion, spatial perception parameters. The program was applied to the children once a week (45 minutes) for eight weeks. As a result of the research, it was determined that there was an increase in children's visual perception skills and reading skills.

Başar et al. (2020) carried out a study to give the first literacy activities to children with reading difficulties. As a result of the research, they found that the child studying at home with his/her parents had a noticeable improvement in both reading skills and spatial skills.

Mathematics Difficulty (Dyscalculia)

Mathematics difficulty is a specific learning difficulty that develops due to congenital or later developmental cerebral problems. According to DSM V (2013), mathematics difficulties are seen as problems in number perception and correct and fluent calculation abilities. mathematics learning difficulty, which is another specific type of learning difficulty, is the fact that children cannot learn mathematical symbols and patterns, as well as confuse perceptions such as place-direction and space. This situation may cause the inability to use mathematics, which is very important in daily life, as well as cause accidents and injuries (Doğan, 2018; Uyanık & Kandır, 2010). Since children with mathematics difficulties cannot understand what any number means, they look for answers to the number or mathematical problems they are asked by using methods such as counting their fingers or using objects. This situation shows that their abstract thinking abilities are not developed, and therefore, children experience major failures in learning (Emek, 2008).

Children with mathematics difficulties have problems not only in mathematical operations, but also in space, quantity, place-direction perceptions, positive and negative values, concepts such as borrowing, and cannot perceive these problems. At the same time, they cannot reach a solution because they cannot understand the problems based on words. These children, who have problems in ordering information and events, do not understand mathematical operations, cannot predict what fractions mean, cannot use money, cannot change money, cannot perceive patterns, cannot write mathematical terms, confuse the concepts of time, cannot arrange the pages, cannot put the numbers in order and cannot do the division operations. Another feature observed in these children is that they cannot draw simple geometric shapes or name the drawn shapes (Akın & Sezer, 2010; Doğan, 2018).

In the studies conducted, it is stated that one of the main reasons for the mathematics difficulties is the problems experienced in visual perception. As a result of the child's inability to perceive symbols visually, mathematical signs and symbols cannot be defined, patterns and shapes can be confused, and the child has difficulties in determining and perceiving the concept of place and direction. For this reason, the necessity of using visual perception programs effectively to prevent this difficulty in children is also emphasized (Floyd, Evans & McGrew, 2003; Geary, Hamson & Hoard, 2000; Mazzocco & Myers, 2003; Pieters et al., 2012; Sortor & Kulp, 2003; Vukovic & Siegel, 2010).

Polat (2013) designed a web-supported curriculum for children with reading, mathematics, and writing difficulties and wanted to determine whether children made progress in reading, mathematics, and writing with the implementation of this curriculum. After the program was prepared and applied to the children, it was determined that the children actively participated in learning activities and their motivation and performance increased.

Doğu, Borandag, and Şahinaslan (2019) stated that visual perception problems in specific learning difficulties can be improved with some programming steps. It was emphasized that with the implementation of this program, the difficulties related to specific learning difficulties in children can be overcome.

Difficulty in Motor Planning (Dysgpraxia)

Problems in motor coordination cause children to be unable to balance, make clumsy movements, and cause problems in self-care skills that require fine motor skills or academic skills such as writing and drawing. These children may have difficulties in motor planning and controlling both sides of the body simultaneously. Such difficulties experienced by children lead to poor hand-eye coordination, and poor hand-eye coordination results in their inability to organize their body movements and belongings. These children, who are extremely sensitive to touch, are disturbed by loud and repetitive sounds and may overreact (Doğan, 2018).

Nonverbal Learning Difficulty

The children in this group, which was defined by Myklebust in 1975, are very difficult to diagnose since they do not have difficulties in reading, understanding, or mathematics, as in the children in the other group. Therefore, children in this group are often more likely to be confused with children with behavior problems or attention deficit hyperactivity disorder.

Children with non-verbal learning difficulties have features such as; weakness in fine and gross motor skills which are called as motor skills, imbalance, coordination problems in visual memory and visual perception expressed as visuospatial skills, and behaving outside the expected norms in social communication skills which means showing an appropriate social development. For this reason, these children frequently experience exclusion from the group due to their unexpected and appropriate reactions, and this situation is an important obstacle to their learning along with all development areas (Doğan, 2018; Korkmazlar, 2003).

SUPPORTING VISUAL PERCEPTION IN SPECIFIC LEARNING DIFFICULTIES

The problems experienced in the visual perception process, which has an important place among the causes of specific learning difficulties, make us think that the visual perception development of these children should be supported. In this context, the visual perception training program developed by Marianne Frostig has an important place. The education program developed by Dr. Marianne Frostig, which states that children's visual perception problems can be supported by some techniques, offers suggestions that other perceptions should be supported in solving problems experienced in visual perception. In this context, for example, the importance of addressing more than one perception of the child, not a single perception, is emphasized, in this context, for example, the importance of specifying how the letter is pronounced and using programs that appeal to the child's sense of touch are emphasized, in addition to the fact that the child receives the letters with the sense of sight. Dr. Marianne Frostig also underlines that as a result of the continuous repetition of this learning experience directed to the child, it can enable the child to internalize the learning (Aral, 2021).

In the program, the subject area that is determined to be taught to children is specified first, and the child learns this subject area through active experiences, by playing, by doing and by living. Information received through listening is transferred to visual-motor activities. All subjects are presented based on perception and based on the principles of learning by doing. All activities start with preparatory activities, taking into account the developmental characteristics and readiness of children, and progress gradually. Children are taught the subjects based on their immediate environment and they develop further. In this context, the child first learns the body concept and image, eye movements and progresses by combining what s/he has learned with various body movements. With the Frostig Visual Perception training program, training is provided for all types of specific learning difficulties, so that children configure learning processes such as eye-motor coordination, shape-ground relationship, shape stability, spatial location perception, and spatial relationships perception, and these configured processes contribute to children’s learning and to the support of all developmental areas of them (Aral, 1994; Aral, 2002; Aral, 2010; Aral & Erturan, 1999; Aral, 2021; Bütün-Ayhan & Aral, 2016; Doğan, 2018; Mangır & Çağatay, 1987).

The result of the researches conducted (Başar et al., 2020; Doğu et al., 2019; Karakaya & Altuntaş, 2017; Leung et al., 2016; Magnan & Ecalle, 2006; Polat, 2013; Poon et al., 2010; Skiada et al., 2014) shows that the problems experienced in visual perception have an important place in specific learning difficulties and that successful results can be obtained when these problems are applied with technology-oriented training or different programs. In this context, with the teaching programs that will be prepared and applied for the individual characteristics of the children rather than the traditional teaching methods, a solution will be found for the problems arising from the specific learning difficulties of the children and every child will be able to learn.

RESULT AND SUGGESTIONS

For children with specific learning difficulties and especially for problems in visual perception, Dr. The training program developed by Marianna Frostig has shown its effect over time. It should not be forgotten that, starting from this trend, configuring the education in accordance with the individual and developmental characteristics of these children and taking into account today's technological programs, instead of traditional teaching techniques, can help children gain academic skills, and at the same time contribute to the development of self-esteem and self-confidence of children and eliminate emotional and behavioral problems. It can be suggested to expand the education programs other than traditional education.

REFERENCES

Ahmetoğlu, A., Aral, N., & Bütün- Ayhan, A. (2008). A comprative study on the visual perceptions of children with attention deficit hyperactivity disorder. *Journal of Applied Sciences, 8*(5), 830-835. https://doi.org/10.3923/jas.2008.830.835

Akın, A., & Sezer, S. (2016). Diskalkuli: Matematik öğrenme bozukluğu. *Bilim ve Aklın Aydınlığında Eğitim, 126*(127), 41-48.

Alexander, A. W., & Slinger, A. M. (2004). Current status of treatments for dyslexia: Critical review. *Journal of Child Neurology, 19*(10), 744-758. https://doi.org/10.1177/08830738040190100401

Alkan, N. (2008). *8-12 yaş çocuklarına uygulanan "Sözel olmayan öğrenme güçlüğü skalası" sonuçlarının karşılaştırılması.* (Unpublished Master Thesis, Marmara University).

Aral, N. (1994). Frostig Görsel Algılama Testi ve eğitim programının özel eğitimde kullanılması. *1. Eğitim Bilimleri Kongresi.* Cilt 1, 349-358, Adana: Çukurova Üniversitesi Eğitim Fakültesi.

Aral, N. (2002). *Serebral palsili çocuklarda görsel algılama: Spastik çocuklar günleri.* İstanbul: Türkiye Spastik Çocuklar Vakfı.

Aral, N. (2010). Okul öncesi eğitimde görsel algılama. In A. Orakçı & N.R. Gürsoy (Eds.), *Geçmişten geleceğe okul öncesi eğitim* (pp. 202-214). Ankara: MEB Okul Öncesi Eğitim Genel Müdürlüğü Devlet Kitapları Döner Sermaye İşt. Müd.

Aral, N., Erturan, N. (1999). Frostig Görsel Algılama Testi ve eğitim programına dayalı olarak dört- sekiz yaş arası serebral palsili çocuklarda görsel algılama davranışının incelenmesi. *Özel Eğitim Dergisi, 2*(3), 58-63. https://doi.org/10.1501/Ozlegt_0000000038

Aral, N., & Yücelyiğit, S. (2014). Bebeklerde algı. In D.L. Gallahue, J. C. Ozmun, J.D. Godway (Eds.), (Çev. Eds. D.S. Özer ve A. Aktop), *Motor gelişimi anlamak: Bebekler, çocuklar, ergenler, yetişkinler* (pp. 154-166). Ankara: Nobel.

Aral, N., & Sağlam, M. (2016). Sensory development in infants. In E. Atasoy, R. Efe, I. Jazdzewska & H. Yaldır (Eds.). *Current advances in education* (pp. 264-277). Sofia: St Kliment Ohridski University Press.

Aral, N. (2021). Öğrenme sürecinde görsel algılama. *Uluslararası Erken Çocukluk Eğitimi Çalışmaları Dergisi, 6*(2), 43-82.

Arı, M. (2018). Özgül öğrenme güçlükleri. In N. Metin (Ed.). *Özel gereksinimli çocuklar* (pp. 219-319). Ankara: Anı Yayıncılık.

Ataman, A., & Kahveci, G. (2009). Öğrenme yetersizliği ya da özgül öğrenme güçlüğü. In A. Ataman (Ed.). *Özel gereksinimli çocuklar ve özel eğitime giriş* (pp. 153-170). Ankara: Gündüz Eğitimi ve Yayıncılık.

Başar, M., & Goncu, A., Baran, M.S. (2020). Öğrenim güçlüğü yaşayan öğrencilerin eğitiminde bir eylem araştırması. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi, 51,* 327-348. https://doi.org/10.9779.pauefd.687030

Bee, H., & Boyd, D. (2009). *Çocuk gelişim psikolojisi.* (Çev. O. Gündüz). İstanbul: Kaknüs Yayınları.

Berk, L. E. (2013). *Bebekler ve çocuklar: Doğum öncesinden orta çocukluğa.* (Çev. N. I. Erdoğan). Ankara: Nobel Akademik Yayıncılık.

Bezrukikh, M. M. ve Terebova, N. N. (2009). Characteristics of the development of visual perception in five to seven year old children. *Human Physiology, 35*(6), 37-42. https://doi.org/10.1134/S0362119709060048

Bulduk, S. (2014). *Duyum ve algı psikolojisi.* İstanbul: Nobel Tıp Yayınları.

Bütün- Ayhan, A., Akı, E., Mutlu, B., Aral, N. (2015). A study of conceptual development and visual preception in six- year old children. *Perceptual and Motor Skills, 121*(3), 1-8. https://doi.org/10.2466/24.10.PMS.121c22x7

Bütün- Ayhan, A., Aral, N. (2016). Frostig Görsel Algı testinin Türkçeye uyarlanması. *The Journal of Academic Social Science Studies, 50,* 1-22.

Çakır, M. (2014). *Görsel kültür ve küresel kitle kültürü.* Ankara: Ütopya Yayınevi.

Demirel, Ö. (2013). *Kuramdan uygulamaya eğitimde program geliştirme.* (5th ed.). Ankara: Pegem Yayıncılık.

Deniz, E., Erözkan, A. (2008). *Psikolojik danışma ve rehberlik.* (3th ed.). Ankara: Maya Yayınları.

Doğan, H. (2018). Özgül öğrenme güçlüğü gösteren çocuklar. In N. Aral & F. Gürsoy (Eds.). *Özel gereksinimli çocuklar ve eğitimleri: Özel gereksinimli çocuklar.* (pp. 45-66). Ankara: Hedef Yayınları.

Doğu, F., Borandağ, E., Şahinaslan, Ö. (2019). Disleksi bireyler için eğitim platformu. In V. Tecim & M.Ö. Kalaç (Eds.) *Engelsiz bilişim- 2019* (pp. 69-83). Manisa: Celal Bayar Üniversitesi Rektörlük Basımevi Müdürlüğü.

DSM 5 (2013). *Tanı ölçütleri başvuru kitabı.* (Çev. E. Köroğlu). Ankara: HYB Yayıncılık.

Elemek, M.A. (2008). *Öğrenme bozukluğu olan çocuklarda benlik saygısının ve kaygı durumunun incelenmesi.* (Unpublished Master Thesis, Marmara University).

Engel- Yeger, B., Nagauker- Yanuv, I., Rosenblum, S. (2009). Handwriting performance, self reports and perceived selfefficacy among children with dysgraphia. *American Journal of Occupational Therapy, 63,* 183-192. https://doi.org/10.5014/ajot.63.2.182

Ercan, Z.G. (2001). *Kaynaştırılmış ortamdaki normal gelişim gösteren çocukların 8-11 yaşları arasındaki öğrenme güçlüğü olan akranlarına karşı tutumlarının incelenmesi.* (Unpublished Master Thesis, Ankara University).

Erdemir, N. (1999). *Algısal becerilerin geliştirilmesine yönelik etkinlikler. Gazi Üniversitesi Anaokulu/ Anasınıfı Öğretmen El Kitabı.* İstanbul: Ya- Pa Yayınları.

Farroni, T., Menon, E. (2008). Visual perception and early brain development. *Encyclopedia on Early Childhood Development.* https://www.academia.edu/5100852/Visual_Perception_and_Early_Brain_Development

Feder, K.P., Majnemer, A. (2007). Handwriting development, competency, and intervention. *Developmental Medicine and Child Neurology, 49,* 312-317. https://doi.org/10.1111/j.1469-8749.2007.00312.x

Floyd, R.G., Evans, J.J., McGrew, K.S. (2003). Relations between measures of Cattell- Horn-Carroll (CHC) cognitive abilities and mathematics achievement across tje school- age years. *Psychology in the Schools, 40,* 155-171. https://doi.org/10.1002/pits.10083

Frostig, M., & Maslow, P. (1973). *Learning problems in the classroom.* New York and London: A Subsidiary of Harcourt Brace Jovanovich Publishers.

Gabbard, C.P. (2008). *Lifelong motor development.* (5th Edition). US: Pearson Education.

Geary, D.C., Hamson, C.O., Hoard, M.K. (2000). Numerical and artihmetical cognition: A longitudinal study of process and concept deficits in children with learning disability. *Journal of Experimental Child Psychology, 77,* 236-263. https://doi.org/10.1006/jecp.2000.2561

Goldstand, S., Koslowe, K.C., Parush, S. (2005). Vision, visual- information processing, and academic performance among seventh- grade school children: A more significant relationship than we thought? *American Journal of Occupational Therapy, 59,* 377-389. https://doi.org/10.5014/ajot.59.4.377

Gülpınar, M. A. (2005). Beyin/zihin temelli öğrenme ilkeleri ve eğitimde yapılandırmacı modeller. *Kuram ve Uygulamada Eğitim Bilimleri Dergisi, 5*(2), 272-306.

Güzel-Özmen, R. (2008). Öğrenme güçlüğü olan öğrenciler. In İ. H. Diken (Ed.). *Özel gereksinimi olan öğrenciler ve özel eğitim* (pp. 335-366). Ankara: Pegem Yayıncılık.

Harwell, J.M. (2008). *Complete learning disabilities handbook.* (3rd Edition). San Francisco: Jossey Based.

Karakaya, B., Altuntaş, O. (2017). Disleksili olan çocuklarda görsel algı becerilerinin, okuma becerileri üzerine etkisinin incelenmesi. *Ergoterapi ve Rehabilitasyon Dergisi, 5*(3), 161-168. https://doi.org/10.30720/ered.428537

Keleş, E., Çepni, S. (2006). Beyin ve öğrenme. *Türk Fen Eğitimi Dergisi, 3*(2), 66-82.

Kellman, P.J., Arterberry, M.E. (2006). Perceptual development the handbook of child psychology. *Cognition, Perception and Language, 6,* 109-160.

Kocayörük, E., Çelik, B. (2017). Öğrenme. In N. Aral & T. Duman (Eds.). *Eğitim psikolojisi* (pp. 270-291). Ankara: Pegem Akademi.

Korkmazlar, Ü. (2003). Okul öncesi dönemde öğrenme sorunlarını tanımak. *Okul Öncesi Eğitim, Sorunlar ve Çözümler Sempozyumu, Bildiri Metinleri* (pp. 27-36). İstanbul: Özel Okullar Derneği Yayınları.

Korkmazlar, Ü., Sürücü, Ö. (2007). Öğrenme bozuklukları. In A. A. Soykan & T. Y. Işık (Eds.). *Çocuk ve ergen ruh sağlığı ve hastalıkları* (pp. 307-326). İstanbul: Golden Print.

Kurdoğlu, F. (2001). Dikkat eksikliği hiperaktivite bozukluğu ve özgül öğrenme güçlüğü. In A. Soykan- Aysev (Ed.). *Özgül öğrenme bozukluğunda tanı değerlendirme* (pp. 43-55). Ankara: Ankara Üniversitesi Basımevi.

Kurtz, L.A. (2006). *Visual preception problems in children with AD/HD autism and other learning disabilities: A guide for parents and professionals.* London: GBR Jessica Kingsley Publishers.

Leung, M.M.P., Lam, C.S.Y., Lam, S.S.T., Pao, N.W.Y., Li-Tsang, C.W.P. (2016). The effect of a combined visual efficiency and perceptual- motor training programme on the handwriting performance of children with handwriting difficulties: A pilot study. *Optometry & Visual Performance, 4*(2), 62-71.

Longcamp, M., Anton, J.L., Roth, M., Velay, J.I. (2003). Visual presentation of single letters activates a premotor area involved in writing. *Neuroimage, 19,* 1492-1500. https://doi.org/10.1016/S1053-8119(03)00088-0

Magnan, A., & Ecalle, J. (2006). Audio-visual training in children with reading disabilities. *Computers & Education, 46,* 407-425. https://doi.org/10.1016/j.compedu.2004.08.008

Mangır, M., & Çağatay, N. (1987). *Anaokuluna giden ve gitmeyen dört- altı yaş arası çocukların görsel algılamaları üzerinde bir araştırma.* Ankara: AÜ Ziraat Fakültesi Yayınları.

Mazzocco, M.M., & Myers, G.F. (2003). Complexities in identifying and defifing mathematics learning disability in the primary school- age years. *Annals of Dyslexia, 53,* 218-253. https://doi.org/10.1007/s11881-003-0011-7

Oktay, A. (2018). Eğitimin temel kavramları. In Z.F. Temel & N. Aral (Eds.). *Gelişimsel destek programları: Tanımlar ve programlar* (pp. 12-32). Ankara: Hedef Yayınları.

Özden, Y. (2003). *Öğrenme ve öğretme.* (5. Baskı). Ankara: Pegem Akademi.

Peng, P., & Fuchs, D. (2016). A meta analysis of working memory deficits in children with learning difficulties: Is there a difference between verbal domain and numerical domain? *Journal of Learning Disabilities, 49*(1), 3-20. https://doi.org/10.1177/0022219414521667

Pieters, S., Desoete, A., Roeyers, H., Vanderswalmen, R., & van Waelvelda, H. (2012). Behind mathematical learning disabilities: What about visual perception and motor skills? *Learning and Individual Differences, 22,* 498-504. https://doi.org/10.1016/j.lindif.2012.03.014

Polat, E. (2013). *Özel öğrenme güçlüğü yaşayan öğrenciler için web destekli uyarlanabilir öğretim sistemi tasarımı.* (Unpublished Master Thesis, Sakarya University).

Poon, K.W., Li-Tsang, C.W.P., Weiss, T.P.L., Rosenblum, S. (2010). The effect of a computerized visual perception and visual- motor integration training difficulties. *Research in Developmental Disabilities, 31,* 1522-1560. https://doi.org/10.1016/j.ridd.2010.06.001

Rodrigues, A.P., Rebola, J., Jorge, H., Ribeiro, M.J., Perreiro, M., van Asselen, M. (2017). Visual perception and reading: New clues to patterns of dysfunction across multiple visual channes in developmental dyslexiavisual channels in dyslexia. *Investigative Ophthalmology & Visual Science, 58*(1), 309-317. https://doi.org/10.1167/iovs.16-20095

Salman, U., Özdemir, S., Salman, A.B., Özdemir, F. (2016). Özel öğrenme güçlüğü "Disleksi". *FNG & Bilim Tıp Dergisi, 2*(2), 170-176. 10.5606/fng.btd.2016.031

Sarıpınar, E.G. (2006). *Özgül öğrenme güçlüğü: Okuma güçlüğünde akademik beceri ve duyusal- motor işlevleri değerlendirme testlerinin kullanılabilirliği.* (Unpublished Master Thesis, Ankara University).

Senemoğlu, N. (2013). *Gelişim, öğrenme ve öğretim: Kuramdan uygulamaya.* (23. Baskı). Ankara: Yargı.

Siegel, M.A.L. (2007). *Nolo's lep guide learning disabilities.* (3rd Edition). USA: Delta Printing.

Skiada, R., Soroniati, E., Gardeli, A., Zissiz, D. (2014). Easylexia: A mobile application for children with learning difficulties. *Procedia Computer Science, 27,* 218-228. https://doi.org/10.1016/j.procs.2014.02.025

Snowling, M. (2005). Specific learning difficulties. *The Medicine Publishing Company Psychiatry, 4*(9), 110-113. https://doi.org/10.1383/psyt.2005.4.9.110

Sortor, J.M., Kulp, M.T. (2003). Are the results of the Beery- Buktenica Developmental test of visual- motor integration and its subtests related to achievement test scores? *Optometry and Vision Science, 80,* 758-763.

Uyanık, Ö., Kandır, A. (2010). Okul öncesi dönemde erken akademik beceriler. *Kuramsal Eğitim Bilim, 3*(2), 118-134.

Vinter, A., Chartel, E. (2008). Visual and proprioceptive recognition of cursive letters in young children. *Acta Psychologica, 129,* 147- 156. https://doi.org/10.1016/j.actpsy.2008.05.007

Vukovic, R.S., Siegel, L.S. (2010). Academic and cognitive characteristics of persistent mathematics difficulty from first through fourth grade. *Learning Disabilities Research and Practice, 25,* 25-38. https://doi.org/10.1111/j.1540-5826.2009.00298.x

Yücelyiğit, S., Aral, N. (2016). Üç boyutlu (3d) animasyon filmler ve etkileşimli uygulamaların okul öncesi dönem çocuklarının görsel algı gelişimi üzerine etkileri. *Eğitim ve Bilim, 41*(188), 255-271. http://dx.doi.org/10.15390/EB.2016.6743