Effectiveness of sensory learning programs in visual and perceptual skills of children with learning disabilities

Fatemeh Rajabi Fard¹, Mahnaz Esteki², Kambiz Poushneh³, Mehdi Alizadeh⁴

1- MA of exceptional Children Psychology, Islamic Azad University, Tehran central branch, Tehran, Iran
2- Assistant professor, Islamic Azad University, Tehran central branch, Tehran, Iran
3- Assistant professor, Islamic Azad University, Tehran central branch, Tehran, Iran
4- Faculty member of Medical Sciences University, Tehran, Iran

Abstract

The research purpose is to assess the effectiveness of sensory learning programs in visual and perceptual skills of children with learning disabilities. Therefore, the sample comprised 20 children with learning disorders in the age range of 7 to 11 years old who were matched and assigned to the experimental and control groups. The data gathering tools included Stanford-Binet inventory to assess the learning disorder and Gardner test of visual-perceptual skills (non-motor)-revised (TVPS-R) to evaluate the perceptual and visual skills. Results indicated that sensory and multi-sensory learning program exerts significant effect on improving the variables of distinguishing visual stimulus presentation, visual memory, persistence of memory, and sequencing. Moreover, data indicated no effect on the improvement of the variables of visual and perceptual relationships, visual form constancy, visual – motor integration and visual perception.

Keywords: learning disorder, perceptual and visual skills, and sensory learning program.

Introduction

The term of Individuals with Disabilities Education Act (IDEA) refers to children's disability who may have problems in one or several basic psychological processes related to the language or its usage, speaking or writing. This disorder may present itself as impairment in listening, thinking, reading, writing, spelling or mathematical calculations. This expression encompasses perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, or developmental aphasia and does not include visual, hearing or motor disabilities, mental retardation, emotional disorder or cultural, economic and environmental undesirable condition (Lerner, 1997). Students with learning disabilities show a variety of learning and behavioral characteristics that are not found all simultaneously. On the other hand, academic failure in a child's first school experience will produce negative and long-standing effects on the motivation and emotional condition of the child. There are several common features in such children including 1) less motor skills, 2) cognitive problems for processing information, 3) the inability to establish and enrich cognitive strategies for learning, 4) linguistic problems, 5) problems reading, 6) writing language problems, 7) problems with Mathemetic and 8) inadequate social behavior (Lerner, 1997).

Given the different existing definitions about the learning problems as well as considering different goals, attitudes, values, causes and objectives for these students, the estimated prevalence varies between of 1 and 3 percent (Javadian, 1992). The official tables of statistics Exceptional Children report the prevalence of this disorder to be between 4 and 12 percent and in some cases up to 30% (Self- Naraghi and Naderi, 1992). Children with specific deficits in learning, have different social and motor patterns that differs from other children including...
hyperactivity (Frick & Lahey, 1991), low activity (Goldstein, translated by H. Moein, 2008), dissonance, repetition (Farahbod, 2005), speech and language disorders (Faryar, 2000), symbolizing disorders (Kirk, 2004) attention disorders including inattention and excessive attention (Lerner, translated by Danesh, 1997), memory impairment (Milne, 1999), impaired visual perception (Lerner, 2005), and visual information processing disorders (Canro, 1962). Ten years of longitudinal studies carried out on individuals with learning disorders have indicated that these individuals show weaker performance in occupational and educational realms and have higher percentage in criminal acts, taking drugs, suffering from mental illness and accidents as compared to other individuals (Drabick, Gadow and Sproflkin, 2006).

(Koppiz, 1973), after several years of research on children with learning disabilities, came to the conclusion that these children are immature, disorganized and they need more time to learn and grow. He refers that, when they are given enough time and helped to compensate for their hindrance, they make some changes in education. They often need one or two more years to complete the school as compared to other students (Ahmadi and Kakavand, 2003). There's no sole or specific reason for this disorder and some genetic, developmental and environmental factors may contribute to the emergence of learning disorders (Kaplan, 2003). The most common therapeutic methods for such children is listed as follows, pharmaceutical therapy, perceptual-motor method, multi-sensory method for the development of language, and training effective methods to children (Seif, 2003). The treatment of learning disorders requires time and children should have access to beneficial and scientific evidence due to the stability of the learning disorder (Fisher, translated by Tavakoli Zadeh, 2007). The treatment of this disorder is investigated such as many other psychiatric disorders of children in two axis of pharmaceutical and non-pharmaceutical therapies (Arnheim and Sinclair, 1938). From among the non-pharmaceutical therapies, balance, attention, concentration, coordination, working on visual, auditory and motor perception through neural approaches are highlighted. In fact, what is the priority of such interventions is the improvement of symptoms including attention and concentration (Alizadeh, 2008).

One of these interventions that has been supported in various studies and have the highest share in the decrease of symptoms is the sensory learning. This program is a multi-sensory approach to improve the process of learning throughout growth that influence the simultaneous stimuli of light, motor and sound, visual, auditory and motor systems. This program leads to the cooperation of the basic sensory programs and better adjustment with multi-sensory outputs. This phenomena lays the foundation for all sorts of sensory processes (Euler, 2006). Sensory learning program effectively changes the structure of brain performance and behavior and increases the perceptual and learning skills (Edler, 2006). The special characteristics of this program include 1- Simultaneous multi-sensory stimulation (visual, auditory and vestibular) 2- needing a minimum motivation for the program of 3- independence of the program to cognitive health system 4- emphasis on the sensory inputs instead of the behavioral response 5- sensory learning program as basic and fundamental therapy (Bolles, 2001). Research by Austin, Young and Stanford (2004), indicates the multi-dimensional effect of multi-sensory learning program in brain responses. The American work therapy association (1997) and Smith and Byron (1999) argue that the sensory learning program can be a reasonable approach for some of the general spectrum of problems, such as problems with sensory-motor integration, autism, dyslipidemia, learning disability and retardation (Syper, 2005). Also, a study Bolles (2001) on 5 children with behavioral problems showed the positive effect of sensory learning program in the improvement of behaviors and cognitive skills of these children.

Studies on the effectiveness of sensory learning in the improvement of autism's symptoms indicate the effectiveness of this program in the improvement of eye contact, attention, reaction and responding to communications and dialogue (Mosheim, 2007). Short-term results of sensory learning programs often include improved cognitive abilities and learning skills, motor skills, social, emotional and behavioral reactions, regulation of arousal levels of the brain and cognitive abilities (attention, concentration, memory, etc.) (Bolles, 2001). Most researchers who research in the realm of students with learning disorders believe that academic skills such as reading and writing are part of the core skills within the education and are strongly related to visual perception skills. Statistical analysis shows a relatively high percentage (4% to 12% and in some cases up to 30% and 3% to 14% in learning disorders such as reading, writing and mathematics) (Seif Naraghi and Naderi, 2003).
Naraghi and Naderi, 2002). Michael Bassett and Johnson believe that visual dyslexia are impaired in their perception and visual memory. These people usually have troubles in orientation, change of size and shape, recognizing the word as a whole, visual processing and spatial visualization. In other words, this group experience difficulties in organizing, interpretation of visual stimuli and distinguishing or copying the letters, words or shapes. With regard to the relationship between reading and the ability to see, defects in the visual process are very important and should be considered as part of the diagnostic process (Thompson, 1995; cited in Seif Naraghi and Naderi, 2006).

Diagnosing the children and pre-school students who have developmental problems is of crucial importance in their normal evolution and growth. Determination of pre-school population paves the way for proving the required helps. Moreover, preventive assessments should be carried out to avoid the potential problems that will occur in the future due to their growth and evolution (Kirk & Chalfant, 1989; translated by Ronaghi et al, 1998). The basic theory in teaching pre-school children puts forward that timely diagnosis and implications can lead to significant differences in children’s growth and development and not only decrease the academic failures but also prevents their emergence (Dadsetan, 2000). Fletcher & Foorman (1994, cited in Danesh, 2005) have emphasized on the primary prevention and diagnosis. Maximizing the effectiveness of therapy in children with learning disabilities should be the main focus of the prevention and primary interventions for children at risk to avoid the increase of specific disabilities in learning. In recent years, the education organization assesses the children and their preparedness to enter elementary schools; however, learning disorders have not been regarded and no therapeutic implication is established in this area (Tabrizi, 2007).

Therefore, it seems that precise investigation of perceptual and sensory skills among children is of crucial importance that is usually overlooked by the therapists and there is low possibility of being included among the common therapeutic plans of these children. No research has been conducted on the effectiveness of sensory learning in the symptoms of learning disorders and with regard to the specific feature of this program and the effectiveness of this program in cognitive-behavioral skills, the present research seeks to answer whether or not sensory learning program is effective in visual perception of children with learning disorder.

Method and materials

The research tools included the tools of reaching the reality (Delavar, 2003). With regard to the importance of the subject matter, the research method was experimental with pre-test, post-test and control group design. These methods enable the researcher to precisely and deeply study the important variables, the process of change, reaction and action in the required stages (Sief Naraghi and Naderi, 2006). In the present research, the independent variable was sensory learning program, the dependent variable was visual perception and the control variable was the age range of children between 7 and 11 years old. The statistical population included all the children with learning disability in the age range of 7 to 11 years old referring to the Beautiful Mentality Clinic located in Tehran City in 2011. The statistical population had already received the diagnosis of learning disorder by children’s professional psychologist.

With regard to the nature and type of research methodology, a sample of 20 children was selected using convenience sampling and assigned to the experimental and control groups who underwent the treatment using the tools of sensory learning. The sapling followed this order: a sample of 14 individuals in the age range of 7 to 11 was selected according to the opinions of the experts and neural sciences institute and administration of standford-Binet test, out of whom, 10 individuals were randomly selected as the control group and matched with each other in terms of age. The process of gathering the data and implementation of the research was to collect the medical data related to each of the samples in their medical file, administration of pre-test, treatment process and post-test.

The therapy sessions were a total thirty sessions that included 12, 90-minute sessions that were conducted in the morning and evening in the clinic and 18 sessions conducted at home that were conducted using a portable device in the morning and evening for 20 minutes. There was no gender bias and the questions of the subscales were selected based on their degree of difficulty to measure the different age levels. With regard to the structure, the test measures the specific features of visual
perception. The validity of the test was obtained with regard to the correlation between the subscales and correlation of the subscales with the total test. Low score of correlation between the subscales indicate that each of the subscales assesses the different aspect of visual perception and all the subscales have high correlation with the total score.

The last version of Stanford-Binet test which had been normalized on Iranian population was used to assess the learning disorder and Gardner test of visual-perceptual skills (non-motor)-revised (TVPS-R) to evaluate the perceptual and visual skills. The TVPS-R is non-linguistically oriented and, according to Gardner (1982), the test developer, its stimuli are not culturally bound. It evaluates seven visual perceptual subskills: (1) visual discrimination, (2) visual memory, (3) visual spatial relationships, (4) visual form constancy, (5) visual sequential memory, (6) visual figure ground and (7) visual closure (Gardner 1982). There are 16 items, arranged progressively according to their difficulty, on each of the seven subscales. The subscales consist of various forms and shapes. The TVPS-R is designed to be used with school-age children, between 4 and 12 years of age, who have four or five potential response options to choose from on each subscale item (Gardner, 1982). They respond by selecting the correct choice from a multiple-choice format that does not require motor responses, such as drawing or copying shapes and designs. It is for this reason that the TVPS-R is referred to as being motor-free or non-motor. Depending on the age of the child, it takes approximately 30 to 45 minutes to administer the test and 5 to 10 minutes to score. The child is shown the test plates and asked to point to the correct response from among four or five choices on the card. Scoring is a simple matter of summing the correct responses on each subscale and determining derived scores. The subscale items are scored dichotomously. Limited validity and reliability data are reported in the TVPS-R manual.

The Developmental Test of Visual-Motor Integration (Beery-VMI) is a comprehensive evaluation consisting of a variety of geometric forms to be copied with paper and pencil. The Beery VMI is designed to assess the extent to which individuals can integrate their visual and motor abilities (eye-hand coordination). There are two subtests administered: the Visual Perception subtest, which requires the child to identify parts of their bodies, picture outlines and parts of a picture, as well as pointing to matching shapes. There are only minimal motor requirements on this subtest. In the Motor Coordination subtests; the child is asked to trace the geometric forms with a pencil without going outside of the lines. The child is able to use examples, demonstrations, using starting dots and paths as strong visual aids for the required motor performance. The reliability of the test was reported between 58% and 99% in 1989 (Beery, 1989). The high correlation between the biological age and test scores is indicative of the developmental nature of the test. This correlation has been reported to be .89. There’s no significant difference between the performance of girls and boys and this findings is in line with the results of the research by Satz and Friel (1974), Nye (1977) and Price (1980). (Beery, 1989).

Descriptive (central tendency, distribution and diagram) and inferential statistics (covariance analysis) were used to analyze the data.

Results and findings

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Source of change</th>
<th>Sum of squares</th>
<th>value F</th>
<th>Level of sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual distinguishing</td>
<td>Pre-test</td>
<td>628.95</td>
<td>6.77</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>group</td>
<td>544.17</td>
<td>5.85</td>
<td>.05</td>
</tr>
<tr>
<td>Visual memory</td>
<td>Post-test</td>
<td>1041.95</td>
<td>1.05</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>Pre-test</td>
<td>51.64</td>
<td>4.92</td>
<td>.05</td>
</tr>
<tr>
<td>Visual-spatial relationships</td>
<td>group</td>
<td>478.33</td>
<td>3.73</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>Post-test</td>
<td>116.98</td>
<td>.91</td>
<td>---</td>
</tr>
<tr>
<td>Visual form constancy</td>
<td>Pre-test</td>
<td>348.65</td>
<td>14.38</td>
<td>.01</td>
</tr>
<tr>
<td></td>
<td>group</td>
<td>1853.31</td>
<td>76.48</td>
<td>.01</td>
</tr>
</tbody>
</table>
The results of the first question of the research indicating the effectiveness of sensory learning in the index of sensuous distinguishing was significant in two factors of pre-test and group factor and the effect of pre-test on the factor of group is significant. As observed in table 1, it can be concluded that, the mean of visual discrimination in the experimental group (54.10) is higher than the control group (43.10) and therefore, the sensory learning and multi-sensory stimulants increase the level of individuals' visual distinguishing with learning disorders and strengthen their visual discrimination.

The results of the second question of the research indicating the effectiveness of sensory learning in the index of visual memory was significant in two factors of pre-test and group factor and the effect of pre-test on the factor of group is significant. As observed in table 1, it can be concluded that, the mean of visual memory in the experimental group (52.70) is higher than the control group (41.80) and therefore, the sensory learning and multi-sensory stimulants increase the level of individuals' visual distinguishing with learning disorders and strengthen their visual memory.

In the investigation of the third question of the research, the effectiveness of sensory learning in the index of visual-spatial relationships in two factors of pre-test and group factor was not significant and the effect of pre-test was not significant in the effect difference and in the experimental and control groups. It means that, visual-spatial relationships are not significantly different in the experimental and control group. Emphasis on the mean of each group confirms this claim. For want of better word, sensory learning and presenting multi-sensory stimulants do not exert much effect on strengthening the visual-spatial relationships.

The results of the fourth question of the research indicating the effectiveness of sensory learning in the index of visual form constancy was significant in two factors of pre-test and group factor and the effect of pre-test on the factor of group is significant. As observed in table 1, it can be concluded that, the mean of visual form constancy in the experimental group (61.50) is higher than the control group (41.30) and therefore, the sensory learning and multi-sensory stimulants increase the level of individuals' visual distinguishing with learning disorders and strengthen their visual form constancy.

The results of the fifth question of the research indicating the effectiveness of sensory learning in the index of visual sequential memory was significant in two factors of pre-test and group factor and the effect of pre-test on the factor of group is significant. As observed in table 1, it can be concluded that, the mean of visual sequential memory in the experimental group (58.40) is higher than the control group (46.10) and therefore, the sensory learning and multi-sensory stimulants increase the level of individuals' visual distinguishing with learning disorders and strengthen their visual sequential memory.

In the investigation of the sixth question of the research, the effectiveness of sensory learning in the index of visual figure ground distinguish in two factors of pre-test and group factor was not significant and the effect of pre-test was not significant in the effect difference and in the experimental and control groups. It means that, visual figure ground distinguish is not significantly different in the experimental and control group. Emphasis on the mean of each group confirms
this claim. For want of better word, sensory learning and presenting multi-sensory stimulants do not exert much effect on strengthening visual figure ground distinguish.

The results of the seventh question of the research indicating the effectiveness of sensory learning in the index of visual completion was significant in two factors of pre-test and group factor and the effect of pre-test on the factor of group is significant. As observed in table 1, it can be concluded that, the mean of visual completion in the experimental group (55.50) is higher than the control group (44.10) and therefore, the sensory learning and multi-sensory stimulants increase the level of individuals’ visuals distinguishing with learning disorders and strengthen their visual completion.

In the investigation of the eighth question of the research, the effectiveness of sensory learning in the index of visual motor integration in two factors of pre-test and group factor was not significant and the effect of pre-test was not significant in the effect difference and in the experimental and control groups. It means that, visual motor integration is not significantly different in the experimental and control group. Emphasis on the mean of each group confirms this claim. For want of better word, sensory learning and presenting multi-sensory stimulants do not exert much effect on strengthening visual motor integration.

In the investigation of the ninth question of the research, the effectiveness of sensory learning in the index of visual perception in two factors of pre-test and group factor was not significant and the effect of pre-test was not significant in the effect difference and in the experimental and control groups. It means that, visual perception is not significantly different in the experimental and control group. Emphasis on the mean of each group confirms this claim. For want of better word, sensory learning and presenting multi-sensory stimulants do not exert much effect on strengthening visual perception.

The results of the seventh question of the research indicating the effectiveness of sensory learning in the index of motor coordination was significant in two factors of pre-test and group factor and the effect of pre-test on the factor of group is significant. As observed in table 1, it can be concluded that, the mean of motor coordination in the experimental group (2.90) is higher than the control group (62) and therefore, the sensory learning and multi-sensory stimulants increase the level of individuals’ visuals distinguishing with learning disorders and strengthen their motor coordination.

**Discussion and conclusion**

The present research aimed to investigate the effectiveness of sensory learning program in the improvement of visual perception’s skills in children suffering from learning disorder. Results indicated the effectiveness of sensory learning program and presentation of multi-sensory stimulants in the increase of individuals’ learning who have learning disorder and it also strengthened their visual discrimination. This finding is in line with the results of the research by Bolles (2001). In the study by Bolles, the visual discrimination of 5 children improved after the implementation of sensory learning. This effect can be attributed to the improvement and strength of sensory processes in the basic level of cortical and brain levels and also the interaction of these (Kendall, 2008). The program of sensory learning with emphasis on the integrative sensory principles improves the filtration stages and selection of right sensory stimulants from among the environmental disturbing stimulants. Therefore, in the diagnosis and visual discrimination, the therapist helps the individuals be able for better visual discrimination through improving the visual stimulants’ process (Beery, 1989).

This program increases the learning level of individuals with learning disorders and also strengthens their visual memory and is one of the cognitive and also stable effects of all sensory integrative techniques in different kinds of memory. Sensory learning program with more emphasis on the presentation of visual stimuli and creating a wide range of such stimulants can result in the improvement of attention and visual memory and through this, positive processes of memory, memorizing and naming the stimulants are done faster and better (Beery and Fisher, 1999).

Sensory learning and presentation of multi-sensory stimuli was effective in strengthening the visual-spatial relationships. Skills of perceiving the space relationship stands amongst the advanced
parts of visuals perception and it's the later consequence of sensory learning that needs better interaction in the brain; because, this program is based on improving the sensory processes without any kind of direct education and it seems that sensory learning program based on direct education can be effective in strengthening the visual-spatial relationships.

Moreover, this program strengthened the visual form constancy in children. Visual form constancy is among the non-motor parts of visual perception that is the results of improvement in attentional and conscious systems of the individual that lead to the strength of cognition of object and the stability of its cognition in the long-term memory and the improvement of this item can be attributed to the effects of sensory learning program in the strength of visual discrimination, visual memory and selective attention (Fisher, 1999).

Sensory learning program and delivering multisensory stimulants increase the level of individuals’ learning with learning disorder and strengthen their visual sequential memory. Improvement of visual sequential memory can be attributed to the mutual effects of attention system and visuals memory. The sensory learning program can result in the improvement of the sensory processing in basic senses and the effects of these senses on high level senses such as hearing and visuals that leads to the improvement of stable attention in the individual. One of the pre-conditions of the improvement of visual sequential memory is sustained attention. Sensory learning program increases the range of individual’s attention that results in the improvement of individual’s visual memory and memorizing the sequencing stimuli.

Presentation of multi-sensory stimuli was not effective in distinguishing visual figure ground. Improvement of visual figure ground stands amongst the advanced parts of visuals perception and it’s the later consequence of sensory learning that needs better interaction in the brain; because, this program is based on improving the sensory processes without any kind of direct education and it seems that sensory learning program based on direct education can be effective in strengthening the visual-spatial relationships.

This program also strengthens the visual completion in children. Visual completion is amongst visual parts’ perception that needs the improvement in all the perceptions’ process. It seems that sensory learning program leads to the strength of visual completion through affecting the visual processes, sustained and selective attention, in a way that the child can retrieve all the general information related to that stimulant and remember it by seeing a stimuli and selective attention.

Presenting multi-sensory stimulants do not exert significant effects on strengthening the motor-visual coordination. In the explanation of this finding, it can be mentioned that, if motor-perceptual programs are added to the sensory learning program, the effects can be observed in the realm. No similar study has been conducted with which to compare the results. Multivariate stimulants didn’t exert significant effect in the strength of visual perception. With regard to the fact that, sensory learning is effective in different parts of visual perception in TVPS test and not on Beery test, it can be concluded that TVPS is a non-motor test and assess a component that is not based on movement. It’s clear that these aspects are significantly correlated to the attention system and memory of individuals. Therefore, employment of integrative traditional therapies that require higher degree of motor parts can be more effective.

Investigation of the data indicates that integrative sensory program with emphasis on the integration of senses and movement (such as deep and vestibular) can improve the motor coordination in children. However, in visual motor integration and visual perception, this factor was not significant and these two factors need to improve the integration between visual systems in occipital lobe and frontal lobe. This is the long-terms result of integrative sensory method and the basic performance in visual system such as visual systems are the faster consequences of visual-motor performances (ecolomotor). However, performances (visual motor integration) emphasize on the integration of traditional therapies of SI on the vestibular performances in later months (Alizadeh, 2011). Moreover, the difference of the results of visual perception in TVPS test and Beery test can be related to the assessment of complex performances of visual perceptions in Beery test. TVPS test is the visual perception without movement and Berry visual perception performance is along with movement and therefore, in this subscale, the null hypothesis is confirmed and the research hypothesis is rejected.

The findings of this research confirm the basic theory in teaching pre-school children puts
forward that timely diagnosis and implications can lead to significant differences in children’s
growth and development and not only decrease the academic failures but also prevents their
emergence (Dadsetan, 2000).

(Koppiz1973), after several years of research on children with learning disabilities, came to the
conclusion that these children are immature, disorganized and they need more time to learn and grow.
He refers that, when they are given enough time and helped to compensate for their hindrance, they
make some changes in education. They often need one or two more years to complete the school as
compared to other students (Ahmadi and Kakavand, 2003). Therefore, multi-sensory education
programs can be regarded as effective programs in the growth and organization of visual and motor
perception skills.

It’s proposed that, this research be carried out on larger sample to have more external validity
and generalization of the data. Moreover, it’s suggested that, long-term effects of sensory learning
device be studied in the visual perception of the students.

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