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Effect of Multisensory Training on Writing Skills of Children with Dysgraphia

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Abstract: ***Aim: To find the effect of multisensory training on writing skills in children with dysgraphia. Objective: To assess the writing skills in children with dysgraphia. To assess visual perception, motor coordination and visuomotor integration skills in children with dysgraphia. To evaluate the effect of multisensory training on writing skills in children with dysgraphia. Methodology: 30 dysgraphic children were selected for study according to screening test of writing assessment measure (WAM) and Berry visual motor integration scale. Participants were into two groups .15 samples in experimental group and 15samples in control group. Experimental group underwent 12 sessions of intervention. Result: Statistical significant is present in experimental group with regard to the effectiveness of multisensory training on writing skills in children with dysgraphia. Statistical significance have been observed in experimental group pre and post test "t" values of VMI, VP, MC are 5.29,14.78 and 13.22. Conclusion: The result of this study shows there is a significant improvement in writing skills for dysgraphic children after multisensory training programs.***

Keywords: Dysgraphia, Multisensory training, occupational therapy, visual perception

1. Introduction

Historically, children who performed academically low than expected are named as learning disability (LD) (Kavale & Forness, 2006). According to Diagnostic and Statistical Manual of Mental Disorders, IV-TR (2000) learning disability is classified as ,Reading Disorder , Mathematics Disorder, Written Expression Disorder, Learning Disorder Not otherwise specified.

Handwriting is an important means of communication that enables the expression, recording, and transmission of ideas of students throughout their educational careers. Elementary school children typically spend up to 50% of the school day engaged in writing tasks, some of which are performed under time constrains. A child's ability to write legibly, as well as quickly and efficiently, enables him or her to achieve both functional written communication and academic advancement.

Dysgraphia or difficulty with writing is defined in the DSM-IV as a disorder in written expression with "writing skills (that) are substantially below those expected given the person's age, measured intelligence, and age appropriate education". Prevalence of dysgraphia is estimated at 5-20%of all students having some type of writing deficit (Reynolds 2007). According to teacher estimates approximately 11% to 12% of female and 21% to 32% of male school age children have handwriting difficulties. The estimated overall prevalence of handwriting difficulties in children with learning disability has been estimated to range between 5% to 27% depending on grade selection criteria and instruments used.

Children experiencing difficulty with handwriting are often referred to occupational therapy for assessment & intervention. Occupational therapy practitioners in the school setting to work with students on improving the abilities and skill needed for academic tasks including handwriting. Problems with handwriting have been identified as one of the most common reasons for referral to occupational therapy services.An occupational therapist works with dysgraphic to improve their writing skills based on multisensory training programs.

Tzu-ying yu etal (2012) in their study demonstrated haptic perception has a greater influence on handwriting speed than kinesthetic perception. Ted Brown and Julia link (2015) recommended visual perception abilities and inhand manipulation skills are significant predictors of children's printing speed and need to be assessed and potentially targeted for skill remediation for children with handwriting difficulties. Hence this study has been proceded with combination of multi sensory training on writing skills of dysgraphic children.

Aim

To find the effect of multi sensory training on writing skills in children with dysgraphia.

Objectives

1) To assess the writing skills in children with dysgraphia.
2) To assess visual perception, motor coordination and visuomotor integration skills in children with dysgraphia.
3) To evaluate the effect of multi sensory training on writing skills in children with dysgraphia.

Null Hypothesis

There will be no significant improvement in writing skills in children with dysgraphia after multi sensory training.

Alternate Hypothesis

There will be significant improvement in writing skills in children with dysgraphia after multi sensory training.

2. Review of Literature

SHAO-HSIA CHANG AND NAN –YING YU (2017)
They investigated a visual–perceptual and haptic–perceptual training program to enhance motor skills and Chinese handwriting performance among children with handwriting difficulties. The participants were 28 first- and second-grade children with handwriting difficulties. Participants in the experimental group received 12 sessions of a training program, whereas those in the control group received conventional handwriting training. The Test of Visual Perceptual Skills—Third Edition (TVPS–3), Tactual Performance Test (TPT), and Battery of Chinese Basic Literacy (BCBL) were all administered before and after 6 week of intervention. Along with the improved visual–perceptual skills, the experimental group showed a significant difference in far-point copy speed and handwriting accuracy, as reflected in the BCBL.

A.J. BREMNER AND C. SPENCE (2017)
Touch is the first of our senses to develop, providing us with the sensory scaffold on which we come to perceive our own bodies and our sense of self. A recent area of interest in tactile research across studies of developing children and adults is its social function, mediating interpersonal bonding. Although there are a range of demonstrations of early competence with touch, particularly in the domain of haptic, the review presented here indicates that many of the tactile perceptual skills that we take for granted as adults. Here, we argue that because touch is of such fundamental importance across a wide range of social and cognitive domains, it should be placed much more centrally in the study of early perceptual development than it currently is.

HAFIZ TAHIR JAMEEL* AND TANZILA NABEEL (2016)
The present study observed the effects of training for Visual Perception (VP) on legibility of Urdu handwriting. 40 students, having poor handwriting, were taken from the 4th and 5th class of general education schools. The VP was measured by using Beery VMI test for Visual Perception. The nominated students in experimental group were trained for six weeks in order to improve VP while the second was a control group without any treatment. It was also noted that the participants in the experimental group presented a significant enhancement in legibility of handwriting when compared with control group.

TED BROWN AND JULIA LINK (2015)
This measures of visual perception, visual-motor integration, and in-hand manipulation skills of school-age children were associated with their manuscript handwriting speed. A convenience sample of 39 typically developing Australian students aged six to eight years completed the DTVMI, the DTVP-3, the Test of In-Hand Manipulation – Revised (TIHM-R), and the Handwriting Speed Test (HST). The DTVP-3 copying and visual closure subscales and the TIHM-R were predictive of total letters written per minute, with the TIHM-R making a significant unique contribution of 9.1% to the total variance of 26%.Visual perception abilities, specifically visual closure skills, plus in-hand manipulation skills appear to be significant predictors of children's printing speed and need to be assessed and potentially targeted for skill remediation when working with school-age children who present with manuscript handwriting difficulties.

FLORENCEBARA AND EDOUARD GENTAZ (2011)
Two studies were carried out in order to better understand the role of perceptual and visuo-motor skills in handwriting. Two training programs, visual–haptic (VH) and visual (V), were compared which differed in the way children explored the letters. The results revealed that improvements of VH training on letter recognition and handwriting quality were higher than improvements after V training. We suppose that VH training was more efficient because it improved both perceptual and visuo-motor skills. In the second experiment, in order to investigate the part of each component, we assessed the link between visuo-motor skills, perceptual skills and handwriting. The results showed that only the visuo-motor tasks predict handwriting copying performance. These results are discussed in relation to the respective roles of the perceptual and visuo-motor skills on letter shape learning and handwriting movement execution.

ANNELOES OVERVELDE WOUTERHULSTI (2010)
This study aimed to map the development and improvement in handwriting during the early grades to differentiate between temporary and consistent dysgraphic handwriting. In this longitudinal and cross-sectional study, children in grade 2 (age 7–8 years, n = 169) and grade 3 (8–9 years, n = 70) took handwriting (Concise Assessment Method for Children's Handwriting; acronym BHK) and visuo motor integration (Beery VMI) screening tests twice within one school year. Dysgraphia decreased strongly from 37% to 17% in grade 2 and diminished further to a low and stable rate of 6% in grade 3. It was concluded that handwriting must be consistently dysgraphic before making any decisions about a diagnosis of dysgraphia or referral for therapy analyses comparing first and second graders with normal or dysgraphic characteristics.

GRAHAM STEVE, HARRIS, KAREN BARBARA (2009)
They conducted a study of hand writing problems in first grade children experiencing writing difficulties participated in 27 fifteen nine sessions, which improve the accuracy and fluency of their hand writing in this findings indicates

HEATHER L. DANKERT, etal. (2003)
Preschool children who receive occupational therapy will demonstrate significant improvement in their visual-motor skills as measured on the Developmental Test of Visual-Motor Integration (VMI) and the two supplemental Visual Perception and Motor Coordination tests. Preschool children with developmental delays (n = 12) received occupational therapy a minimum of one individual 30-minute session, and one group 30-minute session per week for 1 school year. Their performance was compared to that of two control groups; preschool students without disabilities who received occupational therapy (n = 16) for one 30-minute group session per week and students without disabilities (n = 15) who received no occupational therapy. The results of this study demonstrate that intervention, including occupational therapy, can effectively improve visual-motor skills in preschool-aged children.

3. Methodology

Study Design
Quasi experimental design

Sample Size
A total of 30 subjects selected in the study.

Sample Technique
Convenient sampling

Study Setting
The study was conducted at *Occupational Therapy Foundation and Sri Sarvavidhya Multi Speciality Therapy Center.*

Duration Of Study
A total of six months and intervention period 12 sessions.

Inclusion Criteria
- First and second grade children with writing difficulty.
- Age range from 6 to 9 years.
- Both gender

Exclusion Criteria
- Children reporting a history of any medical neurological or pervasive developmental disorder, intellectual disability or oncological, musculoskeletal, sensory (hearing, vision) or skin disorders were excluded from this study

Independent Variable
Multisensory trainings

Dependent Variable
Writing skills of children with dysgraphia.

Measurement Tools/Materials Required

BEERY VMI
The developmental test of visual motor integration was developed by Beery (1967).This helps to assess the extent to which the individual can integrate their visual motor abilities. The short format and the full format tests present drawings of geometric forms arranged order of increasing difficulty that the individual is asked to copy. The short form is used with the children ages 2 to 8 years.

The Beery VMI series also provides supplemental visual perception and motor coordination tests. Administration of Beery VMI for individual and group of short and full form tests is of 10 to 15 minutes each. Visual and motor tests are of 5 minutes' each. Age range limits from 2 to 100 years.

Procedure
A total of 30 subjects were taken in this study. The subjects were selected from OCCUPATIONAL THERAPY FOUNDATION ERODE and SRI SARVAVIDHYA MULTI SPECIALITY THERAPY CENTER between 6 to 9 years of age. The all total 30 subject are dysgraphic along with their writing problems. It is screened by WRITING ASSESSMENT MEASURE (WAM) and tested by BEERY VISUAL MOTOR INTEGRATION SCALE (VMI)
In this experimental group received multisensory training programs to improve writing. The therapy was given for 12 sessions. In which the therapy was given for the time duration of 1 hour per session for each patients.

The pre data were collected from patients at early level with Beery VMI and post data were collected after the treatment with Beery VMI.

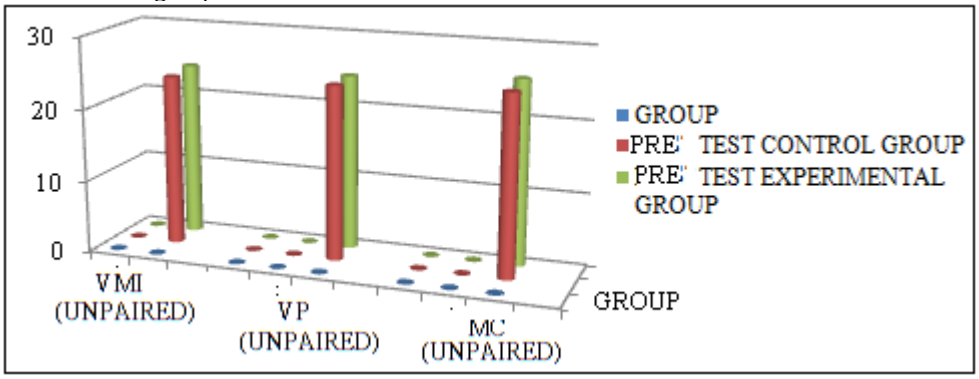
Organisation of Sessions

Each session last for 1 hour:
DAY 1-3
Sterognosis game, Color copy challenge, Paper folding activities, Spinning
DAY 4-6
Sand paper tracing, Therapy putty activities, Picture tracing, Beading, threading
DAY 7-9
Puzzles, Scissor activities, Graph paper: word spacing and sizing, Grid drawing
DAY 10-12
Sentence building using words, Visual motor bingo, Hole punch palooza, Mosaic patterns, Paper Mache

4. Data Analysis and Interpretation

Table 1: Comparison between Pre-Test Values of Experimental Group and Control Group

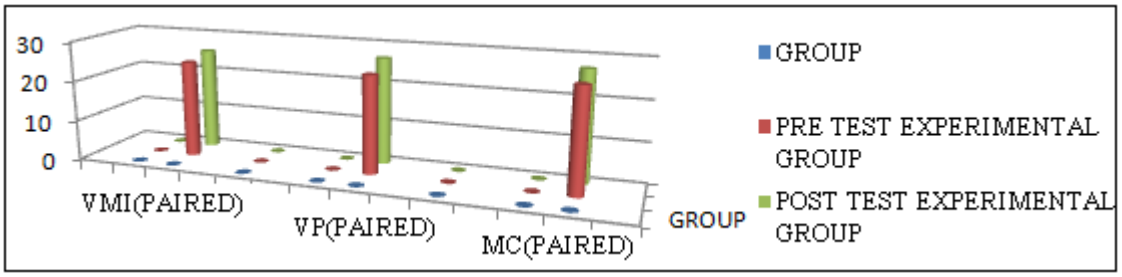
	Group	Test	Mean	S.D	't' Value	'p' Value
VMI	Control group	Pre-test	23.66	1.29	0.92	0.36
	Experimental group	Pre-test	24.13	1.45		
VP	Control group	Pre-test	24.2	1.37	0.27	0.78
	Experimental group	Pre-test	24.33	1.29		
MC	Control group	Pre-test	25.06	1.53	1.01	0.32
	Experimental group	Pre-test	25.6	1.35		



GRAPH: 1 Shows comparison between pre-test values of control and experimental group. In this VMI has mean values of 23.66 and 24.13, 't' value is 0.92 and 'p' value is 0.36,VP has mean values of 24.2 and 24.33, 't' value is 0.27 and 'p' value is 0.78,MC has mean values of 25.06 and 25.6, 't' value is 1.010 and 'p' value is 0.32. This shows there is no significant difference in pre-test values between control group and experimental group in VMI, VP and MC.

Table 2: Comparisons between Pre-Test and Post-Test Values of Experimental Group

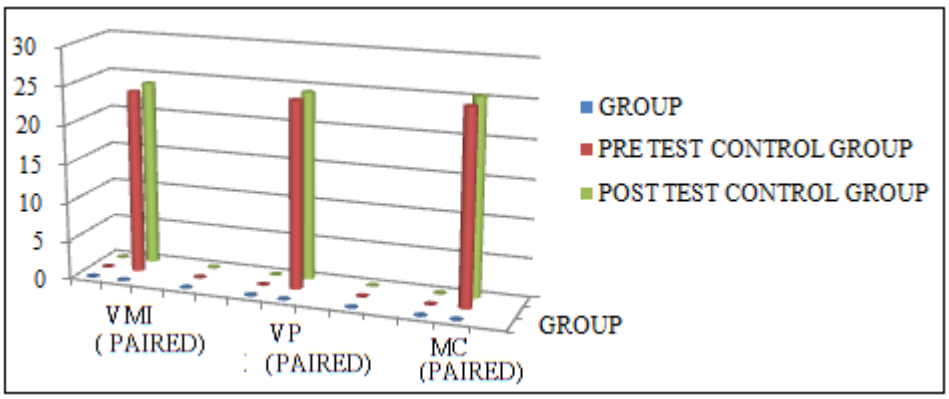
	Group	Test	Mean	S.D	't' Value	'p' Value
VMI	Experimental group	Pre-test	24.13	1.45	5.29	0.0001
		Post-test	25.46	1.45		
VP	Experimental group	Pre-test	24.33	1.29	14.78	<0.0001
		Post-test	26.6	1.54		
MC	Experimental group	Pre-test	25.6	1.35	13.22	<0.0001
		Post-test	27.26	1.38		



GRAPH: 2 Shows comparison between pre and post -test values of experimental group. In this VMI has mean values of 24.13 and 25.46, 't' value is 5.29 and 'p' value is 0.001,VP has mean values of 24.33 and 26.6, 't' value is 14.78 and 'p' value is<0.0001,MC has mean values of 25.6 and 27.26, 't' value is 13.22 and 'p' value is <0.0001. This shows there is extremely significant difference between pre-test and post-test values of experimental group in VMI,VP and MC.

Table 3: Comparisons between Pre-Test and Post-Test Values of Control Group

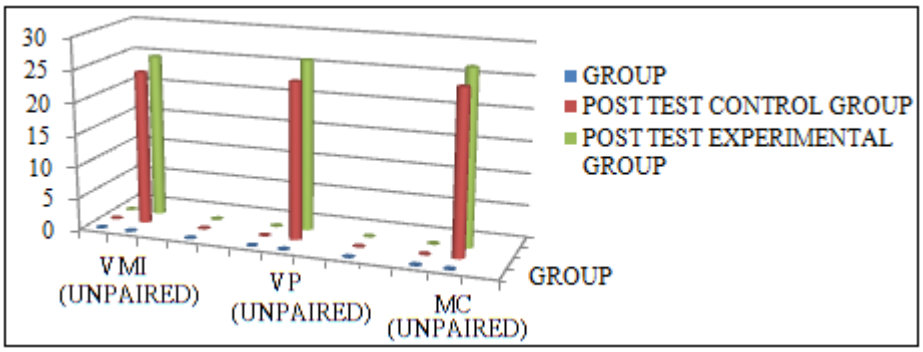
	Group	Test	Mean	S.D	't' Value	'p' Value
VMI	Control group	Pre-test	23.667	1.291	1.169	0.2620
		Post-test	23.9333	1.710		
VP	Control group	Pre-test	24.2	1.373	0.4985	0.4985
		Post-test	24.3333	1.543		
MC	Control group	Pre-test	25.0666	1.534	1.784	0.0961
		Post-test	25.4	1.242		



GRAPH: 3 Shows comparison between pre and post-test values of control group. In this VMI has mean values of 23.66 and 23.93, 't' value is 1.16 and 'p' value is 0.26,VP has mean values of 24.2 and 24.33, 't' value is 0.69 and 'p' value is 0.49,MC has mean values of 25.06 and 25.4, 't' value is 1.78and 'p' value is 0.09. This shows there is not significant difference in pre and post values of control group in VMI, VP and MC.

Table 4: Comparisons Between Post-Test Values Of Experimental Group And Control Group

	Group	Test	Mean	S.D	't' Value	'p' Value
VMI	Control group	Post-test	23.93	1.710	2.64	0.01
	Experimental group	Post-test	25.46	1.457		
VP	Control group	Post-test	24.33	1.543	4.015	0.0004
	Experimental group	Post-test	26.6	1.549		
MC	Control group	post-test	25.4	1.242	3.883	0.0006
	Experimental group	Post-test	27.26	1.387		



GRAPH: 4 Shows comparison between post-test values of control and experimental group. In this VMI has mean values of 23.9333and 25.4666, 't' value is 2.643 and 'p' value is 0.0133,VP has mean values of 24.333 and 26.6, 't' value is 4.015 and 'p' value is 0.0004,MC has mean values of 25.4 and 27.2666, 't' value is 3.883 and 'p' value is 0.0006. This shows there is an extremely significant difference in post-test values between control group and experimental group in VMI, VP and MC.

5. Discussion

The purpose of the study is to determine the effect of multisensory training on writing in children with dysgraphia.

Initially dysgraphic children were selected based on the inclusion criteria, they were screened using Writing Assessment Measure and assessed using Berry VMI to get the pre-test values.

For the control group there is no intervention given where as Experimental group received 12 sessions of intervention with multisensory training.

Table: 1 shows the comparison between pre-test values of both control group and experimental group. In this VMI has mean values of 23.6 and 24.13,'t' value is 0.92 and 'p' value is 0.36,VP has mean values of 24.2 and 24.33,'t' value 0.27 and 'p' value is 0.78,MC has mean values of 25.06 and 25.6, 't' value is 1.01and 'p' value is 0.32.This shows there is no significant difference in pre-test values between experimental and control group in VMI, VP and MC, considered not statistically significant. It denotes the subjects in experimental group and control group shows unanimity.

Table: 2 Shows comparison between pre and post -test values of experimental group. In this VMI mean values are 24.13 and 25.46, 't' value is 5.29 and 'p' value is 0.001,VP mean values are 24.33 and 26.6, 't' value is 14.789 and 'p' value is<0.0001,MC mean values are 25.6 and 27.2667, 't' value is 13.229 and 'p' value is <0.0001. This shows there is extremely significant difference between pre-test and post-test values of experimental group in VMI,VP and MC. It shows there is significant change in writing after multisensory intervention training in dysgraphic children's. These findings are also supported by SHAO-HSIA CHANG AND NAN –YING YU (2017) they investigated a visual–perceptual and haptic–perceptual training program to enhance motor skills and Chinese handwriting performance among children with handwriting difficulties. The participants were 28 first- and second-grade children with handwriting difficulties. Participants in the experimental group received 12 sessions of a training program, whereas those in the control group received conventional handwriting training. Along with the improved visual–perceptual skills, the experimental group showed a significant difference in far-point copy speed and handwriting accuracy, as reflected in the BCBL.

Table: 3 Shows comparison between pre and post-test values of control group. In this VMI mean values are 23.6 and 23.93, 't' value is 1.169 and 'p' value is 0.26,VP mean values are 24.2 and 24.33, 't' value is 0.69 and 'p' value is 0.49,MC mean values are 25.06 and 25.4, 't' value is 1.784and 'p' value is 0.09. This shows there is no significant difference in pre and post values of control group in VMI, VP and MC, considered not statistically significant.

Table: 4 Shows comparison between post-test values of control and experimental group. In this VMI mean values are 23.93 and 25.46, 't' value is 2.64 and 'p' value is 0.013,VP mean values are 24.3 and 26.6, 't' value is 4.015 and 'p' value is 0.0004,MC mean values are 25.4 and 27.26, 't' value is 3.883 and 'p' value is 0.0006. This shows there is a significant difference in post-test values between control group and experimental group in VMI, VP and MC. This findings are also supported by Hafiz Tahir Jameel* and Tanzila Nabeel (2016) this study observed the effects of training for Visual Perception (VP) on legibility of Urdu handwriting. 40 students, having poor handwriting, were taken from the 4th and 5th class of general education schools. The VP was measured by using Beery VMI test for Visual Perception. The nominated students in experimental group were trained for six weeks in order to improve VP while the second was a control group without any treatment. It was also noted that the participants in the experimental group presented a significant enhancement in legibility of handwriting when compared with control group.

Thus proving the alternate hypothesis and rejecting the null hypothesis. So, findings suggest that multisensory training activities are found to be effective in improving writing skills among dysgraphic children.

6. Conclusion

From this study it is concluded that multisensory training program is effective in improving writing skills in children with dysgraphia.

7. Limitations

- The study is done with limited sample size
- The study is done for short time duration
- Study was done on confined age group between 6 to 9 years.

References

[1] Anneloes (2010), Hand writing development in grade 2 and grade3 primary school children with normal, at risk, or dysgraphic characteristics.
[2] A short term graphmotor progress for improving writing readings skills of first grade students (American journal of occupational therapy).
[3] Barbara Zoltan , "Vision perception &Cognition"
[4] Berry K.E. The Developmental Test of Visual –Motor – Integration5th.
[5] Berninger, V.W., el al. (1997). Treatment of handwriting problems in beginning writers: Journal of Educational Psychology, 89(4), 652-666.
[6] Bremner AJ (2017) Advance Child Developmental behavior.
[7] Case-Smith O'Brien, Occupational therapy for children 6th edition, pg: 555.
[8] Case-Smith, (2002), Effectiveness of school-based occupational therapy intervention on handwriting. American journal of occupational Therapy, 56, 17-25.
[9] Chu,.(1997). occupational therapy for children with handwriting difficulties; A framework for evaluation and treatment. British journal of occupational Therapy, 60, 514-520.
[10] Dankert H.L, Davies P.L and Gavin, W.J (2003).Occupational therapy effects on visual-motor skills in preschool children. American journal of occupational therapy,57,542-549
[11] Feder KP, Majnemer A. Handwriting development, competency, and intervention, Developmental Medicine and Child Neurology 2007; 49:312-317.
[12] Ghai, "Essential paediatrics".7th Ed. (2009).OP Ghai, Vinodhpaul, Arvind Bagga, pg: 40.
[13] Hamestra-Bletz, &Blote, (1993). A longitudinal study on dysgraphic handwriting in primary school. Journal of Learning Disabilities, 26,689-699.
[14] Hand book at pediatrics, 4th edition, A, Santhosh Kumar P(No), 16-17.
[15] N.Sovik.O,Anntzen,and R.Thygesen.Relationof spelling and writing in learning disabilities perceptual and motor skills,64;219-236,1987.
[16] Occupational therapy for children 2nd edition author Pat Neuse Pratt.
[17] Overvelde, A., and Hulstijin, W.(2011). Handwriting Development in Grade2 and Grade 3 primary school children with normal, At risk, or Dysgraphic Characteristics. Research in developmental disabilities, 540-548.
[18] Palisan R.J. dicher CG percept not skills, 1999 jan: 68(3p2):1099-103. Comparison of two test of visual motor development used to assess children with learning disability.
[19] Robert M. Meigman, et.al, "Nelson Essential Peadiatrics",5th ed,2006
[20] Sandra Dunsmuir, Maria Kyriacou, Su Batuwitage,Emily Hinson, An evaluation of the writing assessment measure(WAM) for children's narrative writing.
[21] Shao-Hsia Chang, Nan-Ying (2017), Visual and haptic perceptional training to improve handwriting skills in children with dysgraphia.
[22] S.Rosenblum, P.L. Weiss, and S.Parush, Hand writing evaluation for developmental dysgraphia: process versus product. Reading and writing an interdisciplinary, Journal 17:433-458, 2004. 6.
[23] Ted Brown, Julia Link, Ted Brown (2015). The association between measures of visual perception, visual-motor integration, in hand manipulation skills of school-age children and their manuscript handwriting speed. British Journal Of Occupational Therapy, volume:79 ,issue:3,page:163-171
[24] Tsu-Hsin Howe, Jim Hinojosa,(Jan 2013).Assessing Handwriting Intervention Effectiveness in Elementary School Students: A Two –Group Controlled Study. American Journal Of Occupational Therapy,volume:67,page:19-26
[25] Tzu Ying Yu, Tsu Hsin Howe, Jim Hinojosa.(Jan 2012). Journal of occupational therapy, schools, and early intervention, vol:5 ,pg:43-60.