ORIGINAL RESEARCH PAPER INTERNATIONAL JOURNAL OF PURE MEDICAL RESEARCH

Clinical Research

KEYWORDS: MILD-Borderline, GRAPHIC PRESENTATIONS, AUTOMATIZATION

WRITTEN LANGUAGE :A MISSING FOUNDATION A STUDY BY SPEECH LANGUAGE PATHOLOGIST & TEACHERS

Volume - 7, Issue - 2, February - 2022 ISSN (O): 2618-0774 | ISSN (P): 2618-0766

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INTERNATIONAL JOURNAL OF PURE MEDICAL RESEARCH

ABSTRACT

Introduction:

Handwriting is a very essential functional task for school going children. They expresses their thoughts and knowledge through grapheme, a complex skill that encompasses visuomotor coordination, higher level cognitive processes, perceptual abilities, tactile and kinesthetic sensitivity, motor planning, spatial organization, temporal control and the integration of the written language. Graphemes include alphabetic letters, numerical digits, punctuation marks, and the individual symbols. Most of the school going children has many problems in the school performance and their writing is a main concern. Handwriting problems may stem from a variety of causes, most commonly language, visuo-spatial or motor difficulties and problem in number of components, which includes the child's workstation, posture, writing tool, behavior, writing speed, legibility and content. Factors that contribute to illegible writing are incorrect letter formations or reversals, inconsistent size and heights of letters, variable slant and poor alignment and irregular spacing between words and letters. External factors are instructional procedures and materials used during writing and internal factors are visuomotor skills, visual perception, motor planning in-hand manipulation, and kinesthetic awareness. Many authors have discussed the link between various aspects of cognition—particularly attention, memory, language and handwriting skill. It is suggested that success in handwriting can be optimized when the internal factors are age appropriate. Formal handwriting begins in the Kindergarten year (Zaner-Bloser 1994). The writing skills are developed in six stages. 1st stage is IMITATION from preschool to 1st grade (spatial and temporal concepts, mimicking true writing, acquiring letters and number formations and lacks graphomotor function). In 2nd stage i.e. GRAPHIC PRESENTATIONS in 1st-2nd grade (visual appearances and discovers use of capitalization, punctuation and sentence structure). 3rd stage is PROGRESSIVE INCORPORATION from late 2nd-4th grade (synthetic process and spatial formats i.e. paragraphs, letters). The 4th stage is AUTOMATIZATION from 4th-7th grade and attains cursive writing fluency; their capacity to write and think spatially grows. 5th stage is ELABORATION from 7th-9th grade, where writing is used to express viewpoint and complexity. And 6th stage is PERSONALIZATION AND DIVERSIFICATION in 9th grade and beyond. In this individual writing styles, sophistication of vocabulary and user of figurative language, irony, symbolism occur. A visuo-spatial function represents the brain's highest level of visual processing of mental imagery and navigation to process and rotate 2-D and 3-D objects in mind or to virtually move throughout an image from surrounding in mind. It allows giving directions, helping in moving without bumping into any obstacles, to reproduce drawing or use components to construct objects or shapes. **Need of the present study and specific aims of the study:** Concerning visuo-spatial construction as an importance parameter in handwriting, this study is aimed to know the ability to comprehend visual representations and their spatial relationships in school going children and mentally retarded children and writing outcomes. Visuo-spatial constructional abilities i.e. figure ground concept, visuo-spatial concept, matching and sequencing of object in normal and school going children The comparison of writing abilities on copying and dictation task for capitalization, punctuation, quotation and grapheme structure. The more frequent erroronius feature of visuo-spatial and writing task of school going children. **Methodology:** Present study includes 30 students with 2 group's i.e. as normal and mentally challenged (MILD-Borderline Group) from Gyan Deep Public school and Sai Special school respectively with equal distribution of number and gender selection. All the participant's IQ levels were noted and age range was 9 -11 yrs. Participants were Hindi speakers with a mode teaching as English at school. Prior to testing, the teachers were surveyed regarding their teaching experience and training in handwriting instruction. They were10-15 years with experience and it was reported as no specific handwriting curriculum was used at the kindergarten level. Teaching techniques included demonstration and verbal cueing for letter formation. **Procedure:** Test tools were i.e. Visio-spatial constructional task and writing task in Hindi and English (copying a written sample and dictation task).The participants were tested in classrooms using group procedures for the written task and tested individually for the visuo-spatial task which consisted 20 pictures. Test-sessions were scheduled in collaboration with the teachers and administered in 30-minute time period. The samples and pictures were selected carefully with cooperation of the class tutor and according to the grade level. The test scores for visuo-spatial constructional was 10 (Figure-ground, constructional, concept and sequencing) tasks and writing tasks (capitalization, punctuation, quotation and grapheme-structures) were recorded as present (1) and absent (0) in a score sheet and subjected to group-statistics t-test for the significance. **Result:** Group statistics and paired t-test was used at a significance level of 0.05 (SPSS package version 12.0 is used for statistical analysis). There is a significant difference at 0.05 levels in the visuo-spatial figure ground (t-8.407), visuo-spatial concept (t-5.293), matching (t-6.284) and sequencing (t-3.033). The mean scores for figure ground task for MR is 6.7 as compared to normal (10.6). In the task of visuo-spatial concept (5.3), matching (2.3) and sequencing (0.6) were lowered than the normal. On the task of copying in Hindi there was no significant difference between the group for task of punctuation mark end (t-0.784) at 0.05 level and a significant difference for the task of punctuation mark in between (t-3.576) and grapheme structure (t-2.211) at 0.05 level where as a significant difference was present for English. (Punctuation t- 7.230, at 0.001 level of significance). On dictation tasks in Hindi , grapheme structures (t-1.541) has no significant difference at 0.05 level and a significant difference for the task of punctuation in end(t-4.272) and punctuation in between (t-2.468) at 0.05 level. For all the tasks English has poor performance. **Discussion:** This research investigated whether visuo-spatial complexity regulates the construction of handwriting production. Normal i.e. Group- I participants performed better on the task of visuo-spatial figure ground and written sample of dictation and copying with less efforts by means of correct capitalisation, punctuation, quotation and correct grapheme structure with fewer

capitalisations in between sentences. Particularly sensitive to linguistic effects on handwriting we found the students with a better score of figure ground have a better construction of grapheme structure. But not all the normal has the same performance scores. Whereas the group II i.e. of MR has significant interaction between visuoperceptual to the grapheme structure, resulting poor sequencing and concept of direction. However copying was better but the time bound task was incomplete for group II. This indicated increased processing time of visual to motor task for group II. It was also found that the visuo-spatial concepts though better for the Group I, but all of the participants has better responded for right side concept than left, back concept than front, highest than the lowest, near than far and participants who has strokes and slants in their writings has a concept score low. The written sample displays various grapheme errors of capitalisation of graphemes especially /s/, /v/, /f/ and the punctuations were inadequately used for group II. **Conclusion:** This multi-level conception of orthographic representations is in line with visuo-spatial concept which suggests that visual and spatial concept processes exploit information on grapheme structure (Tainturier & Rapp, 2004). Children with written production problems frequently engage in numerous avoidance behaviors but instead the core visuo-spatial construction skills need to be corrected. At present day early school, the visuo-spatial constructional task should be mandatory for betterment of handwriting skills to supplement educational outcome.

Handwriting is very essential functional tasks for school going children. They express their thoughts and knowledge through grapheme, a complex skill that encompasses visuo-motor coordination, higher level cognitive processes, perceptual abilities, tactile and kinesthetic sensitivity, motor planning, spatial organization, temporal control and the integration of the written language. Graphemes include alphabetic letters, numerical digits, punctuation marks, and the individual symbols. Most of the school going children has many problems in the school performance and their writing is a main concern. Handwriting problems may stem from a variety of causes, most commonly language, visuo-spatial or motor difficulties and problem in number of components, which includes the child's workstation, posture, writing tool, behavior, writing speed, legibility and content. Factors that contribute to illegible writing are incorrect letter formations or reversals, inconsistent size and heights of letters, variable slant and poor alignment and irregular spacing between words and letters. External factors are instructional procedures and materials used during writing (Carlson & Cunningham, 1990; Zaner-Bloser, 1994) and internal factors are visuomotor skills, visual perception, motor planning in-hand manipulation, and kinesthetic awareness (Tseng & Murray, 1994; Weil & Amundson, 1994; Ziviani, 1995). Many authors, (Chu, 1997; Exner & Henderson, 1995; Naka, 1998) have discussed the link between various aspects of cognition—particularly attention, memory, language and handwriting skill. It is suggested that success in handwriting can be optimized when the internal factors are age appropriate. Study by Marian J. Jongmans et al 2003 suggested that different mechanisms underlie the quality of handwriting in children with and without handwriting problems (HWP). Poor quality of handwriting of children with HWP seems particularly related to deficiency in visual-motor integration and visual-perception.

Formal handwriting begins in the Kindergarten year (Zaner-Bloser 1994). The writing skills are developed in six stages. 1st stage is IMITATION from preschool to 1st grade (spatial and temporal concepts, mimicking true writing, acquiring letters and number formations and lacks graphomotor function). In 2nd stage i.e. GRAPHIC PRESENTATIONS in 1st-2nd grade (visual appearances and discovers use of capitalization, punctuation and sentence structure). 3rd stage is PROGRESSIVE INCORPORATION from late 2nd-4th grade (synthetic process and spatial formats i.e. paragraphs, letters). The 4th stage is AUTOMATIZATION from 4th-7th grade and attains cursive writing fluency; their capacity to write and think spatially grows. 5th stage is ELABORATION from 7th-9th grade, where writing is used to express viewpoint and complexity. And 6th stage is PERSONALIZATION AND DIVERSIFICATION in 9th grade and beyond. In this individual writing styles, sophistication of vocabulary and user of figurative language, irony, symbolism occur.

Handwriting difficulties may be attributed to visual-perceptual or visual-motor problems that may render the individual unable to copy (Johnson and Myklebust, 1967). Bain (1990) identifies four characteristics of handwriting difficulties associated with learning disabilities: "unconventional grip, fingers very near the pencil point, difficulty in erasing and trouble with letter alignment".

A visuo-spatial function represents the brain's highest level of visual processing of mental imagery and navigation to process and rotate 2-D and 3-D objects in mind or to virtually move throughout an image from surrounding in mind. It allows giving directions, helping in moving without bumping into any obstacles, to reproduce drawing or use components to construct objects or shapes.

Ellis (1982, 1988) and Margolin (1984) proposed distinction between stages dedicated to letter-shape alignment versus stroke specification on cases of brain damage representing difficulties in producing letters in the intended case (e.g., forza -» F-o-r-Z-A) or specific difficulties in writing in lower- versus uppercase , expected resulting from an impairment in the selection or activation of specific allographic letter shapes.

Research has indicated that Handwriting problems may stem from a variety of causes, most commonly: language, visual spatial or motor difficulties, or a combination of these. It is important to distinguish between the normal and writing disordered children in order to manage further psychosocial difficulties appropriately as better handwriting made children to improve confidence and self-esteem, to increase concentration, better academic performance and to increase the ability to express themselves creatively.

Need of the present study:

Writing of young students is often overlooked by SLPs performing assessments. A writing sample holds valuable diagnostic information that may not be available through assessment of oral language skills alone. Writing difficulties may represent a manifestation of a deeper learning disability. Concerning visuo-spatial construction as an important parameter in handwriting, this study is aimed to know the ability to comprehend visual representations and their spatial relationships in school going children and mentally retarded children and writing outcomes.

Aim of the present study:

Visuo-spatial constructional abilities i.e. visuo-spatial figure ground, visuo-spatial concept, matching and sequencing of object in normal and school going children

The comparison of writing abilities on copying and dictation task for Capitalization, punctuation, quotation and grapheme structure.

The more frequent erroronius feature of visuo-spatial and writing task of school going children.

Methodology:

Present study includes 30 students with 2 groups' i.e. as normal and mentally challenged (MILD-Borderline Group) from Gyan Deep Public school and Sai Special school respectively with equal distribution of number and gender selection. All the participant's I Q level was noted and age range was 9 -11 yrs. Participants were Hindi speakers with a mode of teaching as English at school.

Prior to testing, the teachers were surveyed regarding their teaching experience and training in handwriting instruction. They were 10-15 years with experience and it was reported as no specific handwriting curriculum was used at the kindergarten level. Teaching techniques included demonstration and verbal cueing for letter formation.

Inclusion Criteria:

The subjects' age range was 9-11yrs.
The two groups i.e. mentally challenged and normal group should have no other associated health issues.
IQ below 60 for the MR group were excluded from this study
All the students were Hindi speakers with English as a medium of education.

Procedure:

Written language assessment should include: copying, dictation and spontaneous writing (Luria, 1980) as recommended by ASHA 2003. Test tools were Visuo-spatial constructional tasks and writing task in Hindi and English (copying a written sample and dictation task). The visuo spatial construction tasks were based on the figure ground perception, concept (front-back, right-left, top-down, near-far, above-below, centre), matching and sequencing tasks which were selected according to age of the participants and normalized on 100 normal school going children of the same age. A 50 word sample was selected for writing task and to avoid false positive errors, the writing sample of copy and dictation were two different passages. The samples for writing were selected from the test book of the covered syllabus. Unlined papers were used for the task of writing to observe the alignment and grapheme structure. The participants were tested in classrooms using group procedures for the written task and tested individually for the visuo-spatial task which consisted 20 pictures. Test-sessions were scheduled in collaboration with the teachers and administered in 30-minute time period in back ground language i.e. Hindi and in medium of education i.e. in English. The samples and pictures were selected carefully with cooperation of the class tutor and according to the grade level.

The test scores for visuo-spatial constructional tasks (10 Figure-ground, 4 constructional/matching , 5 concept and 1 sequencing) and writing tasks (capitalization, punctuation, quotation and grapheme structures) were recorded as present (1) and absent (0) in a score sheet and subjected to group-statistics t-test for the significance. The raw scores (Comparison group statistics) of the tests were tabulated below.

Result:

Group statistics and paired t-test was used at a significance level of 0.05 (SPSS package version 12.0 is used for statistical analysis).

There is a significant difference at 0.05 level in the visuo-spatial figure ground (t-8.407), visuo-spatial concept (t-5.293), matching (t-6.284) and sequencing (t-3.033). The mean scores for figure ground task for MR is 6.7 as compared to normal (10.6). In the task of visuo-spatial concept (5.3), matching (2.3) and sequencing (0.6) were lowered in MR group than the normal and the values can be compared in the following table

Table 1 ***Comparative visuo-spatial scores of normal and MR groups.***

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
VISUO-SPATIAL FIGURE GROUND	Equal variances assumed	9.931	.004	-8.407	23	.000	-3.900	.464
	Equal variances not assumed			-7.037	10.073	.000	-3.900	.554
VISUO-SPATIAL CONCEPT	Equal variances assumed	21.840	.000	-5.293	23	.000	-3.633	.686
	Equal variances not assumed			-4.292	9.112	.002	-3.633	.847
MATCHING	Equal variances assumed	31.988	.000	-6.284	23	.000	-1.700	.271
	Equal variances not assumed			-5.075	9.000	.001	-1.700	.335
SEQUENCING	Equal variances assumed	331.200	.000	-3.033	23	.006	-.400	.132
	Equal variances not assumed			-2.449	9.000	.037	-.400	.163

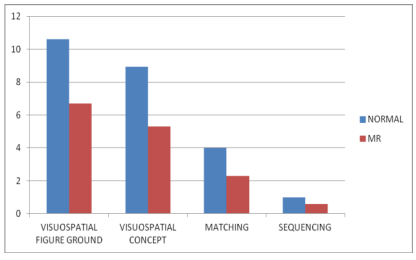


Figure 1. Scores of visuo-spatial task in normal and MR groups.

However in the comparative graph of visuo-spatial perception tasks on "Matching" and "Sequencing" shows equal performance in mentally challenged group and normal group.

On the task of copying in Hindi there was no significant difference between the groups for task of punctuation mark end (t-0.784) at 0.05 level and a significant difference for the task of punctuation mark in between (t-3.576) and graphemic structure (t-2.211) at 0.05 level where as a significant difference was present for English. (Punctuation t- 7.230, at 0.001 level of significance).

As observed from the histogram the performance of MR group on the task of "copying" in English was poor on the "Punctuation Mark In between" the sentences.

Table 2 Comparative scores of copying task in English among normal and MR groups.

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
PUNCTUATION IN END	Equal variances assumed	2.826	.106	.784	24	.440	.063	.080
	Equal variances not assumed			1.000	15.000	.333	.063	.063

PUNCTUATION INBETWEEN	Equal variances assumed	23.890	.000	-3.576	24	.002	-.538	.150
	Equal variances not assumed			-3.074	11.679	.010	-.538	.175
GRAPHEMIC STRUCTURE	Equal variances assumed	11.868	.002	-2.211	24	.037	-.375	.170
	Equal variances not assumed			-2.002	13.776	.065	-.375	.187

Table 3
Comparative scores of copying task in English among normal and MR groups.

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
CAPATALIZATION IN FRONT	Equal variances assumed	21.888	.000	-2.145	23	.043	-.333	.155
	Equal variances not assumed			-1.890	12.035	.083	-.333	.176
CAPATALIZATION INBETWEEN	Equal variances assumed	.	.	3.715	23	.001	.500	.135
	Equal variances not assumed			3.000	9.000	.015	.500	.167
PUNCTUATION IN END	Equal variances assumed	331.200	.000	-4.550	23	.000	-.600	.132
	Equal variances not assumed			-3.674	9.000	.005	-.600	.163
PUNCTUATION INBETWEEN	Equal variances assumed	.334	.569	-7.230	23	.000	-.833	.115
	Equal variances not assumed			-6.934	16.662	.000	-.833	.120
GRAPHEMIC STRUCTURE	Equal variances assumed	331.200	.000	-3.033	23	.006	-.400	.132
	Equal variances not assumed			-2.449	9.000	.037	-.400	.163
QUATION	Equal variances assumed	331.200	.000	-4.550	23	.000	-.600	.132
	Equal variances not assumed			-3.674	9.000	.005	-.600	.163

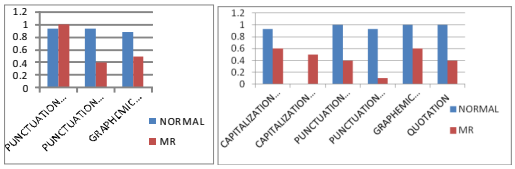


Figure 2. Scores of copying task in Hindi and English among normal and MR groups.

On dictation tasks, the performances were poor for both the language i.e. HINDI and ENGLISH. In HINDI, graphemic structures (t-1.541) have no significant difference at 0.05 level for both groups. A significant difference for the task on punctuation at end (t-4.272) and punctuation in-between (t-2.468) at 0.05 level were found in between the groups. On "Dictation", English has poor performance as tabulated below.

Table 4 Comparative scores of dictation in English among normal and MR groups.

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
CAPATALIZATION IN FRONT	Equal variances assumed	3.680	.068	-1.072	23	.295	-.200	.187
	Equal variances not assumed			-1.025	16.428	.320	-.200	.195
CAPATALIZATION INBETWEEN	Equal variances assumed	.374	.547	-.327	23	.747	-.067	.204
	Equal variances not assumed			-.323	18.654	.750	-.067	.206
PUNCTUATION IN END	Equal variances assumed	331.200	.000	-4.550	23	.000	-.600	.132
	Equal variances not assumed			-3.674	9.000	.005	-.600	.163
PUNCTUATION INBETWEEN	Equal variances assumed	2060.800	.000	-3.243	23	.004	-.533	.164
	Equal variances not assumed			-4.000	14.000	.001	-.533	.133
GRAPHEMIC STRUCTU	Equal variances assumed	3.680	.068	-2.145	23	.043	-.400	.187
	Equal variances not assumed			-2.049	16.428	.057	-.400	.195

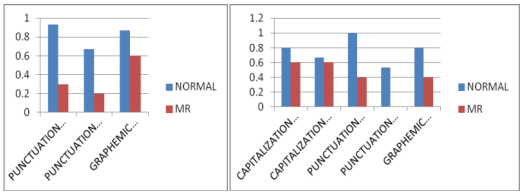


Figure 3. Scores of dictation task in Hindi and English among normal and MR groups.

On the group statistics of writing, both the group had poor performance on dictation as compared to copy task, and it was also found that group had better performance on background language than medium of education. During the task of writing the MR group has less coordination of writing with lesser speed & accuracy and letter formation, spacing, alignment and size were not adequate. This group has also inaccurate visuo-spatial responses as compared to the normal group.

The findings showed a positive relationship between the visuo-spatial skills and handwriting skills. This result supports previous findings that link visuomotor skills to handwriting. Strong positive relationships were found between Visuo-spatial task with handwriting and student's ability to legibly copy letter forms. Students who could write with a better grapheme production and alignment have better score on all Visuo-spatial tasks. This study adds as a growing body of knowledge about the prerequisite skills needed for handwriting.

Discussions:

This research investigated whether visuo-spatial complexity regulates the construction of handwriting production. Visual-motor integration skills were shown to be related to the ability to write. These findings support the research of Weil and Cunningham and Amundson (2003). Normal i.e. Group-I participants performed better on the task of visuo-spatial figure ground and written sample of dictation and copying with less efforts by means of correct capitalization, punctuation, quotation and correct grapheme structure with less capitalization in-between sentences. Particularly sensitive to linguistic effects on handwriting we found the students with a better score of visuo-spatial tasks have a better construction of graphemic structure. But not all the normal has the same performance scores. Whereas the group-II i.e. of MR has significant interaction between visuo perceptual to the graphemic structure, resulting poor sequencing and concept of direction. However copying was better but the time bound task was incomplete for group II. This indicated increased processing time of visual to motor task for group II.

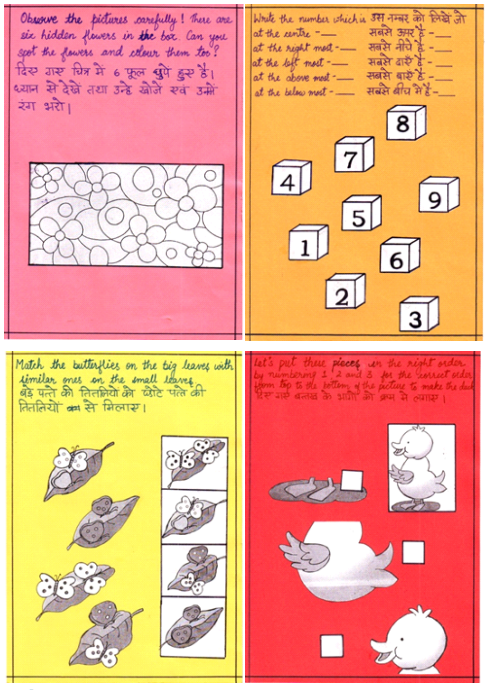
It was also found that the visuo-spatial concepts though better for the Group I, but all of the participants has better responded for right side concept than left, back concept than front, highest than the lowest, near than far and participants who has strokes and slants in their writings has a concept score low. The written sample displays various graphemic errors of capitalization of graphemes especially /s/, /v/, /f/ and the punctuations were inadequately used for group II. The MR children had a BRUSH and CROSS THUMB grasp during the writing task which made them as slow writer.

Conclusion:

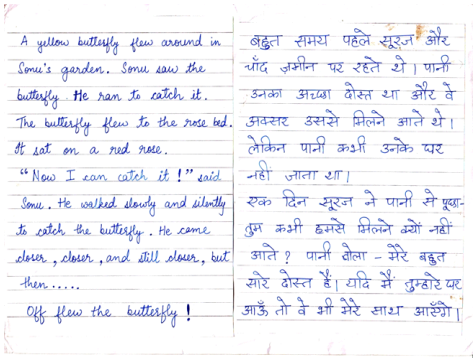
This multi-level conception of orthographic representations is in line with visuo-spatial concept which suggests that visuo and spatial concept processes exploit information on grapheme structure (Tainturier & Rapp, 2004). Children with written production problems frequently engage in numerous avoidance behaviors but instead the core visuo-spatial construction skills need to be corrected. Significant differences found between the children's performances when the written script is concerned. Though the writing needs few prelinguistic and extralinguistic skills, its prerequisites were neglected in present educational system.

Handwriting is an integral part of every child's school experience. In order to provide the best program to children both with and without handwriting problems, elementary educators need to understand the factors underlying the skill of handwriting. This study investigated the relationship between the cognitive understanding of locatives as visuo-spatial and temporal concepts and the graphomotor task of shape and letter copying in typically developing children. At present day, early school, the visuo-spatial constructional task should be mandatory for betterment of handwriting skills to supplement educational outcome.

Appendix-I
Visuo-spatial task sample



Appendix-II
Writing task sample


A yellow butterfly flew around in Sonu's garden. Sonu saw the butterfly. He ran to catch it. The butterfly flew to the rose bed. It sat on a red rose. "Now I can catch it!" said Sonu. He walked slowly and silently to catch the butterfly. He came closer, closer, and still closer, but then.....
Off flew the butterfly!

बहुत समय पहले सूरज और चाँद जमीन पर रहते थे। पानी उनका अच्छा दोस्त था और वे अक्सर उससे मिलने आते थे। लेकिन पानी कभी उनके घर नहीं जाता था। एक दिन सूरज ने पानी से पूछा- तुम कभी हमसे मिलने क्यों नहीं आते? पानी बोला - मेरे बहुत सारे दोस्त हैं। यदि मैं तुम्हारे घर आऊँ तो वे भी मेरे साथ आएँगे।

Acknowledgement:

The authors wants to thank all the participants in the study, specially would like to thank all the teachers of Sai Special School and Gyan Deep Public School to permit us for the sample collection.
Thank you all sweet students; without you our study may not have been accomplished.

Thanks to the Assistant Director, AYJNIHH, NRC (Dr V.P.SAH) to reinforce us for carrying out this study.

And finally thanks to the Director, AYJNIHH, MUMBAI (Dr R.RANGASAYEE) to make us feel proud being an AYJNIHHite.

We are thankful to my friends and family who were a big support for us in the completion of this research.

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