ORIGINAL ARTICLE

Handwriting Evaluation in School-Aged (7-14 Years) Children

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ABSTRACT

Objective: To evaluate handwriting in children aged 7-14 years and to explore the association between illegible handwriting and complaints of pain

Study Design: Cross-sectional study design.

Place and Duration of Study: All students were tested in the department of Audiology, Gulab Devi Teaching Hospital, under the same conditions from February to October 2023.

Material and Methods: 200 healthy students aged 7-14 years (girls = 94 and boys = 106) were included. Students with no physical or mental impairment were included. Students who had received any special education classes were excluded from the study. The participants were taken from Gulab Devi Girls High and Primary School. Informed consent was obtained from class teachers of the students. Handwriting Proficiency Screening Questionnaire (HPSQ) was used to evaluate handwriting in children.

Results: Out of 200 students, a larger number of children aged between 7 and 8 years old. 20.25 % had illegible issues, and 32 % of students had poor performance time and well-being. The association between illegible handwriting and pain complaints was highly significant (p-value < 0.01).

Conclusion: Handwriting difficulties in children are frequently underestimated despite their considerable impact on academic achievement and self-confidence. So, HPSQ can be used to identify any handwriting deficits in school-going children to highlight the problems that children face and thus refer them to occupational therapy for better performance in their lives.

Key Words: *Handwriting problems, Evaluation, Handwriting proficiency screening questionnaire*

INTRODUCTION

Writing is an essential literacy skill that requires both physical and cognitive abilities. It enables individuals to fulfill various academic, professional, personal, and recreational goals.[1] Reading and writing skills are intimately related to the development of literacy skills in children, and these skills frequently reinforce one another during the learning process.[2] In elementary school, children spend a significant portion of their day engaging in writing tasks up to 50%. Therefore, the capability of a child to write with clarity, speed, and efficiency is essential for

achieving both functional written communication and academic advancement.[3,4]

The proficiency of handwriting, especially the fluency of handwriting, tends to enhance as individuals grow older and progress through their schooling.[5] By the age of 8-10 years, children's handwriting becomes automatic, efficient, and easy to read and understand.[6] Therefore, children unable to achieve legible handwriting are called poor hand-writers or dysgraphic. It has been estimated that 11–12% of girls and 21–32% of boys have handwriting difficulties.[7,8] Right-handers showed proficient handwriting skills as compared to left-handers.[9]

Factors that cause poor handwriting performance may be intrinsic, extrinsic, or both, i.e., lack of fine motor control, improper visual-motor integration, hand manipulation skills, grasp pattern, sitting position, chair-desk height, blackboard position, environmental lighting, etc.[10,11] Writing problems can be observed in children with or without disabilities. With regard to illegibility and timing deficits, children often erase more, are unwilling to write or do homework, and complain more about hand pain and fatigue. These all are the manifestations of physical and emotional well-being.[12]

We start utilizing handwriting at a very young age, and it will be useful to us for the rest of our lives. Even though having good handwriting is seen as a secondary talent in the digital era, it can have lifelong advantages. It is advisable to start honing these skills as early as possible. Despite the increasing reliance on computer typing, handwriting remains a critical ability during a child's developmental phase. When students acquire fluent and functional handwriting skills, they can utilize the skills across all subjects to aid in their learning process.[13,14]

Several researches have been conducted on handwriting difficulties. One study suggested that the prevalence of handwriting issues in 6-12 year-old children lies between 6 and 33%.[15] The development of handwriting competency, which is often measured in terms of speed and legibility, has been the subject of several researches[6,16] Different researchers used different standardized tests to evaluate handwriting problems in children with or without any disability.[17] Some studies also suggested that occupational therapy interventions played a vital role in improving handwriting difficulties, visual motor integration, and visual perceptual and fine motor skills. [18]

The present study aims to evaluate handwriting problems in terms of legibility, performance time, and physical and emotional well-being in typical school-going children aged 7 to 14, as during this age period, children achieve advanced fine motor skills, including handwriting. Besides the various handwriting assessment tools available, the Handwriting Proficiency Screening Questionnaire (HPSQ), which is easy to administer and accessible, was used in the present study.

MATERIAL AND METHODS

Two hundred healthy students, ages 7-14 (girls = 94 and boys = 106), were included in this study. 185 participants were right-handed, and 15 students were left-handed. Students with no physical or mental impairment were included in this study. Students who had received any special education classes were excluded from the study.

Data collection procedure: This cross-sectional study used the convenience sampling technique. The participants were taken from Primary Schools. Informed consent was obtained from the students' class teachers. Ethical approval from the Institutional Review Board was granted. All students were tested in the Department of Audiology, Gulab Devi Teaching Hospital, under the same conditions from February to October 2023.

Data collection tools and sample size justification: To get the data for this study, the Handwriting Proficiency Screening Questionnaire (HPSQ) was adopted to evaluate students. It is a validated 10-item questionnaire containing three important handwriting components (legibility containing 1, 2, and 10 items; items 3,4, and 9 belong to performance time, and physical & emotional well-being have 5-8 items). Each item is scored on a Likert scale with 0 'never' and 4 'always' ratings. The reliability of the questionnaire was verified using the usually used instrument Cronbach's Alpha, which was 0.77, which shows the good properties of the questionnaire.[19]

We enrolled 200 participants based on previous researchers, and many of the authors

recommended and agreed that a minimum 200 participants was sufficient for evaluating handwriting in children, so we justified our sample size as sufficient [20]

Data analysis: The SPSS version 23.0 package was used for statistical analysis. Frequencies and percentages were used to report qualitative variables such as age group distribution and gender, as well as the results of the questionnaire (Handwriting Proficiency Screening Questionnaire). The chi-square test was used to examine the association between illegible handwriting and complaints of pain.

RESULTS

In our study, a total sample size was 200, of which 94 were female, and 106 were male. Out of 200 students, the age of most children was between 7 and 8 years (51.5 %), followed by 12 and 13 years in 19.5%, and 14 years in 3.5%. The average age of students was about nine years (SD 1.9). It also showed that 20.25% had illegible issues, and 32% of students had poor performance time and well-being. The association between illegible handwriting and pain complaints was highly significant as the p-value was 0.000.

TABLE 1: Frequency of gender distribution

Gender	Frequency	Percentage
Male	104	52.00
Female	96	48.00
Total	**200**	**100.0**

Fig 2: Frequency distribution group

Age group	Frequency	Percentage
7-8	103	51.5
9-11	51	25.5
12-13	39	19.5
14	7	3.5

Fig 3: Handwriting proficiency screening questionnaire frequency table

	Never	Rarely	Sometimes	Often	Always
Illegible handwriting	92 (46)	61 (30.5)	22 (11.0)	18 (9.0)	7 (3.5)
Unsuccessful in reading his / her own handwriting	54 (27.0)	84 (42.0)	26 (13.0)	19 (19.5)	17 (8.5)
Enough time to copy	16 (8.0)	14 (7.0)	26 (13.0)	56 (28.0)	88 (44.0)
Often erase while writing	19 (9.5)	40 (20.0)	56 (28.0)	55 (27.5)	30 (15.0)
Does not want to write	24 (12.0)	43 (21.5)	63 (31.5)	43 (21.5)	27 (13.5)
Does not want to do homework	32 (16.0)	35 (17.5)	43 (21.5)	58 (29.0)	32 (16.0)
Complains of pain	62 (31.0)	68 (34.0)	33 (16.5)	19 (9.5)	18 (9.0)
Tired while writing	45 (22.5)	78 (39.0)	45 (22.5)	16 (8.0)	16 (8.0)
Needs to look repeatedly while coping	34 (17.0)	89 (44.5)	48 (24.0)	18 (9.0)	11 (5.5)
Unsatisfied with handwriting	11 (5.5)	47 (23.5)	65 (32.5)	50 (25.0)	27 (13.5)

Table 3 shows that 92 students had proficient handwriting, and seven had illegible handwriting.

Fig 4: Association of Illegible handwriting with complaint of pain

		Complains of pain					Total	p-value
		Never	Rarely	Sometimes	Often	Always		
Illegible handwriting	Never	38	30	18	4	2	92	0.000
	Rarely	18	29	10	4	0	61	
	Sometimes	4	8	2	6	2	22	
	Often	2	1	2	5	8	18	
	Always	0	0	1	0	6	7	
Total		**62**	**68**	**33**	**19**	**18**	**200**	

Table 4 showed the association of illegible handwriting with pain and predicted that children who faced difficulty in writing tasks often suffered from complaints of pain with a p-value (0.000).

DISCUSSION

Handwriting difficulty in children is frequently underestimated or not adequately addressed despite their considerable impact on academic achievement and self-confidence. So, our study aimed to evaluate the handwriting that typical school children face during academic performance. Hence the results showed that out of 200 participants with age range of 7- 14 years, we had maximum number of children that belongs to 7- 8 years old as mentioned in table 2.

Moreover, regarding screening questionnaire components, only 7 students reported illegible handwriting always, 22 students as sometimes, and 92 students had legible handwriting, which explains that out of 200 students, 108 had handwriting problems. However, in performance time, most students (44.0%) required more time to copy, 15.0% of students often erased more while writing, and only 3.5 % looked repeatedly while copying from board or other notebooks. 23.25 % of students expressed physical and emotional discomfort while writing, as mentioned in Table 3.

Table 4 investigates the association between illegible handwriting and complaints of pain. It explains that children who suffered from complaints of pain had poor handwriting due to decreased endurance of skills that help in proficient handwriting.

A study was published in 2015 by Sara Rosenblum and Liant Gafni-Lachter et al. to explore the reliability and validity of the Handwriting Proficiency Screening Questionnaire on 230 children in northern Israel. They included 7-14 years of children and divided into two groups based on self-rating.194 participants were in the proficient handwriting group (group 1), and 36 were in the proficient handwriting group (group 2). Their results indicate that the total mean score ranges from 0 to 32, so based on sample size distribution, 75 % scored between 0 and 15, lower 25% scored between 0 and 7.6, and 10 % between 0 and 5. They also concluded that this questionnaire has an excellent property for handwriting evaluation in clinical and academic uses.[19]

Another study evaluated the psychometric properties of screening questionnaires for children with handwriting. For this purpose, the author enrolled 276 (girls=132 and boys = 162) students at the elementary school of Brno, the capital of Czechia. Data was collected from children and teachers also to evaluate the factor structure of HPSQ for teachers and HPSQ for children, respectively. They concluded that HPSQ had excellent validity (0.9) and reliability (0.7). There was a positive correlation between children ($r=0.28$, $p=0.01$) and teacher questionnaires ($r=0.54$, $p=<0.01$). So they recommended that this questionnaire can be used for research purpose and also for clinical usage in order to figure out any handwriting deficits in school going children.[20]

A recent study was conducted in April 2023 to evaluate poor handwriting and its effects on academic performance. This study was conducted at King Khalid University, Saudi Arabia, with a sample size of 64 students. They concluded that those students whose handwriting was unsatisfactory scored lower than those with proficient handwriting.[21]

Limitations: The study's limitation was the minimum sample size that was enrolled from only one school. Moreover, a large sample size from different schools and institutions can produce more productive results.

CONCLUSION

HPSQ can be used to identify handwriting deficits in school-going children as it can predict all the main components of handwriting. It can also be used for clinical or academic evaluation to highlight the problems that children face during academic performance and thus easily refer them to Occupational Therapy for better performance in their lives.

Conflict of interest: There was no conflict of interest regarding the publication of this study.

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REFERENCES

1. Wang EL, Matsumura LC, Correnti R, Litman D, Zhang H, Howe E, Magooda A, Quintana R. eRevis (ing): Students' revision of text evidence use in an automated writing evaluation system. Assessing Writing. 2020 Apr 1;44:100449.
2. Hussein A, Abdulameer AT, Abdulkarim A, Husni H, Al-Ubaidi D. Classification of dyslexia among school students using deep learning. Journal of Techniques. 2024 Mar 31;6(1):85-92.
3. Marrero-Rivera JP, Sobkowiak O, Jenkins AS, Bagnato SJ, Kline CE, Gordon BD, Taverno Ross SE. The Relationship between Physical Activity, Physical Fitness, Cognition, and Academic Outcomes in School-Aged Latino Children: A Scoping Review. Children. 2024 Mar 19;11(3):363.
4. Lopez C, Vaivre-Douret L. Exploratory investigation of handwriting disorders in school-aged children from first to fifth grade. Children. 2023 Sep 6;10(9):1512.
5. Kadar M, Wan Yunus F, Tan E, Chai SC, Razaob Razab NA, Mohamat Kasim DH. A systematic review of occupational therapy intervention for handwriting skills in 4–6 year old children. Australian Occupational Therapy Journal. 2020 Feb;67(1):3-12.
6. Fogel Y, Rosenblum S, Barnett AL. Handwriting legibility across different writing tasks in school-aged children. Hong Kong Journal of Occupational Therapy. 2022 Jun;35(1):44-51.
7. Pedersen MJ, Leonthin H, Mahler B, Rittig S, Jennum PJ, Kamperis K. Two nights of home polysomnography in healthy 7-14-year-old children–Feasibility and intraindividual variability. Sleep Medicine. 2023 Jan 1;101:87-92.
8. Rosenblum S, Dvorkin AY, Weiss PL. Automatic segmentation as a tool for examining the handwriting process of children with dysgraphic and proficient handwriting. Human movement science. 2006 Oct 1;25(4-5):608-21.
9. Kumar C, Mehta P, Rao S. Effectiveness of Physiotherapy for the Handwriting Problem of School Going Children. Indian Journal of Physiotherapy and Occupational Therapy. 2012 Jul 1:117.
10. Abd El-Dayem TS, Salem EE, El-Hadidy EI. Correlation between gross motor activities and hand writing skills in elementary school children. Trends in Applied Sciences Research. 2015 May 1;10(5):259.
11. Chang SH, Yu NY. Computerized handwriting evaluation and statistical reports for children in the age of primary school. Scientific Reports. 2022 Sep 19;12(1):15675.
12. Xu Z, Liu D. Intrinsic and Extrinsic Factors of Handwriting and Their Impacts on Reading: A View from Embodied Cognition. InRoutledge International Handbook of Visual-motor skills, Handwriting, and Spelling 2024 (pp. 136-148). Routledge.
13. van der Merwe J, Smit N, Vlok B. A survey to investigate how South African Occupational Therapists in private practice are assessing and treating poor handwriting in foundation phase learners: Part II-Treatment and evaluation practices. South African Journal of Occupational Therapy. 2011;41(3):11-7.
14. Wang CY, Cheng ZT. Design and Assessment of Children's Pencil Holder for Chinese Writing. Sustainability. 2023 Aug 16;15(16):12421.
15. Dionne E, Bolduc MÈ, Majnemer A, Beauchamp MH, Brossard-Racine M. Academic challenges in developmental coordination disorder: a systematic review and meta-analysis. Physical & occupational therapy in pediatrics. 2023 Jan 2;43(1):34-57.
16. Haberfehlner H, de Vries L, Cup EH, de Groot IJ, Nijhuis-van der Sanden MW, van Hartingsveldt MJ. Ready for handwriting? A reference data study on handwriting readiness assessments. Plos one. 2023 Mar 3;18(3):e0282497.
17. Caravolas M, Downing C, Hadden CL, Wynne C. Handwriting legibility and its relationship to spelling ability and age: Evidence from monolingual and bilingual children. Frontiers in Psychology. 2020 Jun 4;11:1097.
18. Feder KP, Majnemer A. Children's handwriting evaluation tools and their psychometric properties. Physical & occupational therapy in pediatrics. 2003 Jan 1;23(3):65-84.
19. Zainol M, Kadar M, Razaob NA, Wan Yunus FA. The Effectiveness of Occupational Therapy Handwriting Intervention for Children with Motor

Coordination Issues: A Systematic Review. Malaysian Journal of Health Sciences/Jurnal Sains Kesihatan Malaysia. 2022 Jan 1;20(1).

20. Rosenblum S, Gafni-Lachter L. Handwriting proficiency screening questionnaire for children (HPSQ–C): development, reliability, and validity. The American Journal of Occupational Therapy. 2015 May 1;69(3):6903220030p1-9.

21. Šafárová K, Mekyska J, Zvončák V, Galáž Z, Francová P, Čechová B, Losenická B, Smékal Z, Urbánek T, Havigerová JM, Rosenblum S. Psychometric properties of screening questionnaires for children with handwriting issues. Frontiers in Psychology. 2020 Jan 21;10:2937.