

Artikel Ulasan/Review Articles

Review on the Effects of Occupational Therapy Intervention in Improving Handwriting Skills among Preschool Children

(Tinjauan ke Atas Keberkesanan Intervensi Terapi Carakerja dalam Meningkatkan Kemahiran Tulisan Tangan dalam Kalangan Kanak-kanak Prasekolah)

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ABSTRACT

The development of writing ability is not only important in building a child's self-esteem, but also essential for academic success in school. Handwriting is an important skill that could affect students' performance in most academic areas. This study aimed to review the effect of occupational therapy intervention in improving handwriting skills among preschool children. Relevant studies were systematically searched by using standardized keywords across three databases. The initial search identified 1,386 references. Of these studies, there were five quantitative studies that met the inclusion criteria and were methodologically appraised using the McMaster Critical Review Form–Quantitative Studies. All studies reported that preschool children with or without disabilities showed significant improvements in handwriting skills after receiving occupational therapy intervention. One study involved collaboration between teachers and occupational therapists in implementing intervention program to preschool students. Collaboration between teachers and occupational therapists was able to provide teachers with tools and skills that they can use to help students, with or without direct presence of occupational therapists. Overall, findings of this review indicated that preschool children could gain improvement in handwriting skills regardless of their conditions after receiving occupational therapy intervention programs.

Keywords: Occupational therapy; intervention; preschool children; handwriting skills

ABSTRAK

Perkembangan keupayaan tulisan tangan bukan sahaja penting dalam membina keyakinan diri seseorang kanak-kanak, tetapi juga penting dalam pencapaian akademik di sekolah. Tulisan tangan adalah kemahiran penting yang boleh menjejaskan prestasi pelajar dalam kebanyakan bidang akademik. Kajian ini telah menilai kesan intervensi terapi carakerja bagi meningkatkan kemahiran tulisan tangan dalam kalangan kanak-kanak prasekolah. Carian kajian dilakukan secara sistematik dengan menggunakan kata kunci standard di tiga pangkalan data. Carian awal berjaya mengesan sebanyak 1,386 kajian. Antara kajian ini, terdapat lima kajian kuantitatif yang memenuhi kriteria pemilihan dan penilaian penuh ke atas metodologi dijalankan dengan menggunakan McMaster Critical Review Form–Quantitative Studies. Semua kajian melaporkan bahawa kanak-kanak prasekolah samada yang mengalami kurang upaya atau tidak telah menunjukkan kemajuan yang signifikan dalam kemahiran tulisan tangan selepas menerima intervensi terapi carakerja. Terdapat satu kajian yang melibatkan kerjasama antara guru dan ahli terapi carakerja dalam melaksanakan program intervensi kepada pelajar prasekolah telah dijalankan. Kerjasama antara guru dan ahli terapi carakerja dilaporkan dapat membekalkan guru dengan alat dan kemahiran yang boleh mereka gunakan untuk membantu pelajar, samada dengan atau tanpa kehadiran langsung dari ahli terapi carakerja tersebut. Secara keseluruhan, penemuan dari tinjauan ini menunjukkan bahawa kanak-kanak prasekolah walau apa kondisi yang mereka alami, mampu memperolehi peningkatan dalam kemahiran tulisan tangan melalui program intervensi terapi carakerja.

Kata kunci: Terapi carakerja; intervensi; kanak-kanak prasekolah; kemahiran tulisan tangan

INTRODUCTION

Handwriting is an important skill that could affect students' performance across all academic areas (Ainscow 2005; Dinehart & Manfra 2013). The development of writing ability is not only important in building a child's self-esteem, but also, is an essential factor for gaining success in academic performance (Stewart & Simon 1985).

Development of the handwriting skill takes place since birth starting from the maturity of fine motor skills among children. Handwriting skill is highly needed in primary grades especially during kindergarten years, when there are variety of activities that involve fine motor skills including handwriting skills. Children need to learn to correctly form the 26 capital and lower case letters of the alphabet before they can write words and form sentences. There

are multiple techniques as developed by professionals that could be used to teach children to write successfully (Alberto & Troutman 2013; Graham & Harris 2002).

Children typically begin experimenting with writing by the age of two using random scribbling. Although early scribbles lack the characteristics of conventional writing, some universal features such as directionality and linearity in their intentional scribbling could still be observed (Gombert & Fayol 1992). Children begin to learn writing by copying common geometric shapes including vertical strokes, horizontal strokes, circles, and oblique cross, which constitute elements that are most important for writing readiness (Feder & Majnemer 2007).

As children grow older, their fine motor skills also develop further to allow more precise manipulation of objects. Fine motor skills are important for handwriting development. It was discovered that writing errors commonly made by first graders was largely due to difficulties in fine motor control (Feder & Majnemer 2007). Pre-schoolers have immature grasp compared to their older counterparts which influences their ability to produce letters accurately. However, as children gain greater exposure to and experience of writing, their ability to form letters, pseudo-letters or even actual letters, will start to become salient in their writing, especially involving those letters in their names (Gombert & Fayol 1992).

Various occupational therapy interventions have been used to improve handwriting skills among children, according to published research. For instance, a developmental approach based handwriting program that focused on grouping letters by difficulty and teaching a handwriting style using simple and vertical lines (Olsen et al. 2008) as well as the one that focused on neuromotor and biomechanical aspects of handwriting for children with low muscle tone, postural instability, and muscle weakness (Amundson et al. 2001).

As a component of integrated services, the importance of the therapist–teacher relationship had also been emphasized in research (Kadar, Razaob, Mohd Saibani, Chai & Samin 2017). Typically, there is a positive association between the amount of collaborative teaming and teacher’s perceptions of occupational therapy contributions to student skill development, according to a survey of 40 teachers (Barnes & Turner 2001). There is also a positive association between occupational performance scores and teacher awareness of student needs and teacher implementation of occupational therapy strategies, according to an outcome study of 91 school-age children who received occupational therapy for fine motor difficulties (Reid et al. 2006). Prompted by these findings, the aim of this current review was to investigate the effect of occupational therapy intervention in improving handwriting skills among preschool children.

METHODOLOGY

SEARCH STRATEGY

Electronic databases that were systematically searched include: MEDLINE complete, ERIC and EBSCOhost. Initial search terms that were used include: (‘handwriting skills’ OR ‘prewriting skills’ OR ‘handwriting development’) AND (‘occupational therapy intervention’ OR ‘occupational therapy treatment’ OR ‘occupational therapist’) AND (‘preschool children’ OR ‘kindergarten’ OR ‘early childhood’). Secondary searching was also performed to identify any additional studies based on the reference lists of eligible studies.

SELECTION OF STUDIES

This review included only quantitative experimental research studies that were published in academic journals and were peer reviewed. To ensure the retrieved studies were current and up to date, only papers published between January 2008 and December 2018 and in English Language were included in this search. The review excluded: (1) studies with no preschool children involvement, and (2) studies that were irrelevant to occupational therapy intervention, i.e. studies that were not performed by occupational therapists either directly or in collaboration with other professionals. The initial search identified 1,386 studies pooled across all databases searched. Of these, two duplicates were removed before the articles were reviewed. Of the articles reviewed, 52 were selected for full text retrieval to further examine if they met the inclusion criteria of the review. Each of these studies was independently reviewed by the 3rd author to determine the degree to which they met the inclusion criteria. Of these 52 studies, five studies (Figure 1) met the inclusion criteria. The methodological quality of these five studies were critically appraised using the McMaster Critical Review Form–Quantitative Studies by the 1st and 3rd authors.

RESULTS

CRITICAL APPRAISAL OF THE STUDIES

As shown in Table 1, although all five studies have included clear study objectives, relevant literature review, and detailed description of participants and study interventions, only one study gave justification for its sample size decision (Lust & Donica 2011). Sample size needed in the quasi-experimental study by Lust and Donica (2011) was 12 participants per group as calculated using power analysis, however, after dropped-out, they ended up with 17 participants in the experimental group and 15 participants in the control group from the starting

sample size of 20 participants each group. The final sample size were adequate for the study design. Study by Donica, Goins and Wagner (2013) utilised the Shore Handwriting for Early Handwriting Development (SHS) based on its ability to evaluate primary components of effective handwriting in preschool-age children and its brief administration time of 15 to 20 minutes. Since this instrument is an observational checklist, prior to the study, the researchers had developed scoring criteria used to determine an overall percentage score for each child performance for use in the study, which can be considered adequate for the pre- and post-test data collection in this study. However, owing to the SHS being a non-

standardised assessment tool, there is no reliability and validity information available. Most studies in this review were found lacking in control in terms of co-intervention, however, it is highly suggested that future study should be presented with clear intervention protocol and avoiding contamination together with the use of appropriate analysis methods, the study should be able to report clinical importance and drew appropriate conclusions using data obtained. Due to the limited number of studies in this current review and the fact that most of them had at least one methodological weakness, evidence gathered through this current review for the focused area need to be taken with caution consideration by occupational therapists.

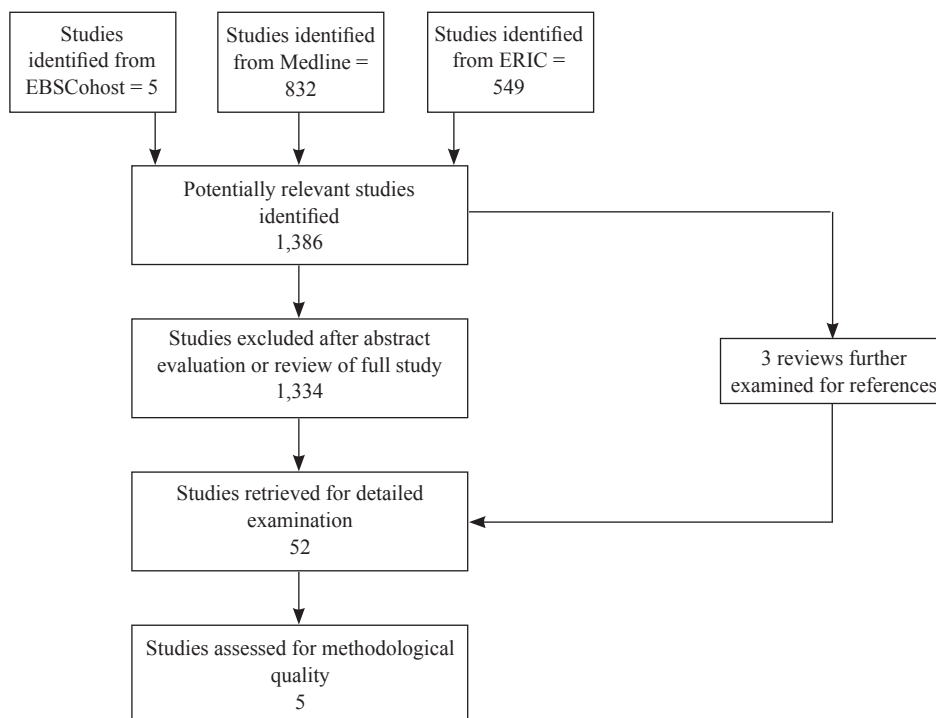


FIGURE 1. Flowchart detailing stages of review

This review summarized the findings descriptively, appropriate for the given review objectives, studies included, and outcomes reported. There were two pre-post research studies (Ohl et al. 2013; Taras et al. 2011), two quasi-experimental studies (Dankert et al. 2003; Donica et al. 2013) and one non-randomized control trial (Lust & Donica 2011). Key metrics and findings of all five studies were presented in Table 2.

In a study by Dankert et al. (2003), preschool children were divided into three groups, i.e., (1) preschool children with developmental delay, (2) preschool children with other disabilities, and (3) preschool children without disabilities. The two former groups were given occupational therapy intervention while the latter was not administered with any occupational therapy intervention. By using the Beery-Buktenica Developmental Test of Visual-Motor Integration (VMI), 5th edition for visual motor skills,

preschool children with developmental delay showed improvements that exceeded typical development. It was also highlighted that intervention approach guided by acquisitional and developmental frame of references can improve visual-motor skill among preschool children with developmental delay.

In Donica et al.'s (2013) quasi-experimental study, there were three groups of preschool children in three preschool classrooms, i.e., A, B, and C. Apart from the regular Head Start curriculum, participated by all three classrooms, both experimental groups, Classroom A and Classroom B also participated in additional programs. Specifically, Classroom A participated in Fine Motor and Early Handwriting Pre-K Curriculum (FMEW) while Classroom B participated in Handwriting Without Tears-Get Set for School program (HWT). Classroom C, the control group, had no participation in any additional

TABLE 1. Study appraisal using McMaster Critical Review Form

	(Dankert et al. 2003)	(Donica et al. 2013)	(Lust & Donica 2011)	(Ohl et al. 2013)	(Taras et al. 2011)
Study purpose					
Was the purpose clearly stated?	✓	✓	✓	✓	✓
Literature					
Was relevant background literature reviewed?	✓	✓	✓	✓	✓
Sample					
Was the sample described in detail?	✓	✓	✓	✓	✓
Was sample size justified?	✗	✗	✓	✗	✗
Outcomes					
Were the outcome measures reliable?	✓	✗	✓	✓	✓
Were the outcome measures valid?	✓	✗	✓	✓	✓
Intervention					
Intervention was described in detail?	✓	✓	✓	✓	✓
Contamination was avoided?	✓	✓	✓	✓	✓
Co-intervention was avoided?	✗	✗	✗	Not addressed	✓
Results					
Results were reported in terms of statistical significance?	✓	✓	✓	✓	✓
Were the analysis method(s) appropriate?	✓	✓	✓	✓	✓
Clinical importance was reported?	✓	✓	✓	✓	✓
Drop-outs were reported?	✗	✓	✓	✓	✓
Conclusions and Implications					
Conclusions were appropriate given study methods and results	✓	✓	✓	✓	✓

Notes: ✓ refers to criteria met within study, ✗ refers to criteria not met

program. Pre- and post-test comparison of each classroom indicates that preschool children in both experimental groups gained greater improvements in their handwriting skills in terms of postural control, hand control as well as letter and number formation. The authors highlighted that length and duration of intervention sessions had influenced the result of the study. Similar pre-post study also found improvements in handwriting skills of preschool children (Taras et al. 2011). Comparisons were made between two groups of children, one with handwriting skill development program implemented by occupational therapists (intervention group) while the other with programs implemented by teachers (comparison group). Children in both groups showed statistically significant improvement between the pre-test and post-test outcome on all handwriting skills assessed. Children who received the handwriting skill intervention showed statistically significantly greater improvement in handwriting skills on letter tasks i.e. approximation, line orientation, proportion, and directionality, and the sentence task i.e. line orientation and proportion, as compared to children who did not receive the intervention. The authors highlighted that occupational therapy is more than just helping students with disabilities. Occupational therapy intervention can also provide significant improvement in the development of fine motor and related skills in typical childhood

population. It was also suggested that schools should one day included occupational therapy towards normal childhood population.

Another study conducted by Lust and Donica (2011) also provides evidence of improvements in handwriting skill in terms of prewriting skills, kindergarten readiness, first name writing, and handwriting-non specific fine motor skills of preschool children. Intervention was implemented by occupational therapists. Both control group and experimental group showed improvements in terms of prewriting skills, first name writing and school readiness. In additions, the experimental group showed significant improvement in terms of prewriting skills, kindergarten readiness and fine motor skills. The authors highlighted the benefits of implementing the program in general classroom settings provided the educator demonstrates appropriate competence in the related areas. However, the long terms effects of this intervention is not determined.

Another study was conducted among general education preschool children and improvements in terms of fine motor and visual motor skill were significant (Ohl et al. 2013). In this study, collaborations were made between occupational therapists and teachers when implementing program to the experimental group. The authors highlighted that occupational therapists play an important role in the effectiveness of strategies and practices that support

TABLE 2. Key metrics and findings for included studies

Author	Design	Participant/Population	Sample size	Model/Outcome Measure	Key findings
Taras et al. 2011	Quantitative (pre-post)	14 kindergarten classes in 12 schools in intervention group and 14 kindergarten classes in 14 schools in comparison group.	Intervention group (n = 201) and comparison group (n = 155).	Effectiveness of occupational therapy strategies for teaching handwriting skill. Measure: Children's Handwriting Evaluation Screening, The Evaluation Tool of Children's Handwriting and The Test of Handwriting Skills.	Children who received the intervention showed statistically significantly greater improvement in handwriting skills between the pre-test and post-test on letter tasks (approximation, line orientation, proportion, and directionality) and the sentence task (line orientation and proportion), as compared to children who did not receive the intervention.
Ohl et al. 2013	Quantitative (pre-post)	12 general kindergarten classrooms in 6 urban elementary schools (6 intervention group and 6 control group).	n = 113.	Effectiveness of intervention program. Measure: Bruininks – Oseretsky Test of Motor Proficiency, 2nd Edition, Beery – Buktenica Developmental Test of Visual – Motor Integration, 5th edition, Developmental Scale of Pencil and Crayon Grips, Therapist–Teacher Interaction Log, survey.	Intervention group showed statistically significant improvements in terms of fine motor and visual-motor performance while control group demonstrated slight decrease in fine motor and visual-motor performance. Both groups showed no significant differences in pencil grip.
Dankert et al. 2003	Quasi-experimental, mixed factor.	Preschool children with developmental delays, disabilities and preschool children without disabilities.	Preschool children with developmental delays (n = 12) and preschool children without disabilities that receive OT treatment (n = 16) and did not receive OT treatment (n = 15).	Effectiveness of occupational therapy treatment on visual-motor skills in preschool children. Measure: Beery– Buktenica Developmental Test of Visual – Motor Integration, 5th edition.	Preschool children with developmental delays who receive occupational therapy made significant gains on the VMI after 8 months of therapy. These gains were acquired at a rate that exceeded typical development.
Donica et al. 2013	Quantitative, quasi-experimental.	Preschool children in a facility (Classroom: A = 16, B = 18, C = 14).	n = 48.	Effectiveness of handwriting programs on postural control, hand control, letter and number formation. Measure: The Shore Handwriting Screening for Early Handwriting Development.	Handwriting programs show significant improvement indicated by change in mean score of postural control, hand control, letter and number formation.
Lust et al. 2011	Quantitative, non-randomized control trial (pre-post).	Preschool children in 2 classrooms (control group and experimental group), rural population.	Experimental group (n = 17) and control group (n = 15).	Effectiveness of handwriting readiness program. Measure: Check Readiness, Bruininks – Oseretsky Test of Motor Proficiency, 2nd Edition.	Experimental group showed significant improvement in Learning Accomplishment Profile 3rd Edition, Check Readiness, Bruininks – Oseretsky Test of Motor Proficiency, 2nd Edition.

needs of students in classroom environment. Short term interventions were also found to have significant effect on fine motor and visual-motor integration skills necessary in handwriting skills. It was suggested that successful collaboration between teachers and occupational therapists could provide teachers with tools and skills that they can use to help students, with or without direct presence of occupational therapists.

DISCUSSION AND CONCLUSION

Overall, the findings from this review indicate that there is improvement in intervention programs implemented by occupational therapist regardless of the participants condition (Dankert et al. 2003; Donica et al. 2013; Lust & Donica 2011; Ohl et al. 2013; Taras et al. 2011). The literatures also highlighted the need for handwriting intervention programs to be implemented in school settings in order to improve handwriting skills among preschool children (Lust & Donica 2011; Taras et al. 2011). This is important as interventions performed in the child's own natural settings could bring much benefits to their learning process.

Most studies reviewed reported significant improvements in both children with disabilities, as well as with children without disabilities (Dankert et al. 2003; Donica et al. 2013; Taras et al. 2011). However, the long term effects of the intervention program implemented is uncertain as no study has yet to provide evidence of the long term effects of occupational therapy intervention in handwriting skills among preschool children (Taras et al. 2011). Besides that, the small sample size of some studies reviewed could undermine the internal and external validity of a study (Faber & Fonseca 2014).

Short-term interventions can have a significant effect on the fine motor and visual-motor integration skills required for readiness in handwriting skills. In addition, active collaboration between teachers and occupational therapists could provide teachers with skills and tools they can use in the future with or without direct presence of occupational therapists in the school settings (Ohl et al. 2013).

One limitation of this review is that it is informed by a small number of study. Hundreds of studies were retrieved across multiple literature searches and of these, only five studies met the inclusion criteria. However, all five studies provided evidence on the improvements of handwriting skills after occupational therapy intervention. Although some of the studies do address the important factors of handwriting skills, further methodologically rigorous studies need to be designed and conducted to understand the effect of occupational therapy intervention in improving handwriting skills among preschool children.

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REFERENCES

- Ainscow, M. 2005. Understanding the development of inclusive education system. *Electronic Journal of Research in Educational Psychology* 3(3): 5-20.
- Alberto, P.A. & Troutman, A.C. 2013. *Applied Behavior Analysis for Teachers*. 6th Edition. Boston, MA: Prentice Hall.
- Barnes, K.J. & Turner, K.D. 2001. Team collaborative practices between teachers and occupational therapists. *American Journal of Occupational Therapy* 55(1): 83-89.
- Dankert, H.L., Davies, P.L. & Gavin, W.J. 2003. Occupational therapy effects on visual-motor skills in preschool children. *American Journal of Occupational Therapy* 57(5): 542-549.
- Dinehart, L. & Manfra, L. 2013. Associations between early fine motor development and later math and reading achievement in early elementary school. *Early Education and Development* 24(2): 138-161.
- Donica, D.K., Goins, A. & Wagner, L. 2013. Effectiveness of handwriting readiness programs on postural control, hand control, and letter and number formation in head start classrooms. *Journal of Occupational Therapy, Schools, & Early Intervention* 6(2): 81-93.
- Faber, J. & Fonseca, L.M. 2014. How sample size influences research outcomes. *Dental press journal of orthodontics* 19(4): 27-29.
- Feder, K.P. & Majnemer, A. 2007. Handwriting development, competency, and intervention. *Developmental Medicine & Child Neurology* 49(4): 312-317.
- Gombert, J.E. & Fayol, M. 1992. Writing in preliterate children. *Learning and instruction* 2(1): 23-41.
- Graham, S. & Harris, K.R. 2002. Prevention and intervention for struggling writers.
- Lust, C.A. & Donica, D.K. 2011. Effectiveness of a handwriting readiness program in head start: A two-group controlled trial. *American Journal of Occupational Therapy* 65(5): 560-568.
- Masne Kadar, Nor Afifi Razaob, Hany Naziha Mohd Saibani, Chai Siaw Chui & Noorashikin Samin 2017. Reframing Services for Malaysian Students in Schools: Time to Bring Occupational Therapy into the Classroom. *Jurnal Sains Kesihatan Malaysia* 15(1) 2017: 67-73.
- Ohl, A.M., Graze, H., Weber, K., Kenny, S., Salvatore, C. & Wagreich, S. 2013. Effectiveness of a 10-week tier-1 response to intervention program in improving fine motor and visual-motor skills in general education kindergarten students. *American Journal of Occupational Therapy* 67(5): 507-514.
- Olsen, J Z., Knapton, E.F. & Fine, E.H. 2008. *Handwriting without tears*. United Kingdom: Handwriting without tears.

- Reid, D., Chiu, T., Sinclair, G., Wehrmann, S. & Naseer, Z. 2006. Outcomes of an occupational therapy school-based consultation service for students with fine motor difficulties. *Canadian Journal of Occupational Therapy* 73(4): 215-224.
- Stewart, S. 1985. Development of written language proficiency: methods for teaching text structure. In Simon, C. (Ed.), *Communication skills and classroom success* pp. 341-361. San Diego CA: College Hill Press.
- Taras, H., Brennan, J., Gilbert, A. & Eck Reed, H. 2011. Effectiveness of occupational therapy strategies for teaching handwriting skills to kindergarten children. *Journal of Occupational Therapy, Schools, & Early Intervention* 4(3-4): 236-246.

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