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## **A Depiction of Handwriting Intervention Guideline for Children with Handwriting Difficulties in Malaysia**

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**Abstract:** Handwriting skill is the major occupational therapy intervention executed by occupational therapists who are working with children. This article aims to describe a newly developed handwriting intervention guideline for occupational therapy service delivery in Malaysia. The handwriting intervention guideline is set up to be applicable for children aged four to nine years. The guideline is presented to support children with handwriting issues in terms of handwriting readiness and writing criteria specifically on capitals, lowercase, and numbers. This article provides a description of the handwriting intervention guideline such as the rationale of this guideline, content structure, and activity modules to guide clinical practice. The guideline has been implemented on a group of children with pre- and post-measures. The outcome findings are demonstrated to show the viability of the guideline to be used by occupational therapy practitioners. This depiction of handwriting intervention guidelines is expected to assist occupational therapy practitioners in conducting handwriting intervention for children to suit our socio-cultural background and educational system.

**Keywords:** Handwriting, Occupational therapy, Intervention guideline, Children

### **Introduction**

Handwriting difficulties might be the important components of learning problems and other neurological issues that affect children in academic and school-related tasks (Milone, 2007). Handwriting skills were included in 30-60% of tasks in schools for children (McHale & Cermak, 1992). The definition of handwriting difficulties was declared as the issues of letter formation that involve dyslexia and dysgraphia characteristics among children (Zainol et al., 2021).

The indicator of a child having handwriting difficulties is a score of below 80 percent from the overall score in handwriting performance using any standardized tool such as The Print Tool, Test of Handwriting Skills-Revised, or Evaluation Tool of Children's Handwriting (Chang and Yu, 2017; Prunty & Barnett, 2017). The prevalence range of children having handwriting difficulties across the world varied in literature within the range of 5-35% (Overvelde & Hulstijn 2011; Volman et al., 2006; Brossard-Racine et al., 2011; Duiser et al., 2020). Handwriting legibility is the main issue among school children with handwriting problems (Lam et al., 2011; Shih et al., 2018).

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## Handwriting Performance Area

Handwriting skills performance involved perceptual-motor function (Volman, Van Schendel & Jongmans, 2006) fine motor skills (Smits-Engelsman et al., 2013), visual motor integration (Weintraub, 2004; Kaiser, Albaret & Doudin, 2009; Duiser et al., 2020) and cognitive function in relation to the poor and slow speed of handwriting (Biotteau et al., 2019; Volman et al., 2006). The effect of handwriting difficulties was found in poor academic performance (Feder & Mejnemer 2007; Barnett et al., 2018; Rosenblum et al 2019), low self-esteem (Prunty & Barnett, 2019; Rosenblum, 2019) low motivation (Brossard-Racine et al., 2012; Waelvelde et al., 2012; Missiuna et al., 2017), reduced life skills (Reta & Elliot, 1994) and behavioral problem (Sandler 1992; Waelvelde et al., 2017). Occupational therapy or physical therapy was claimed to have a positive effect on handwriting skills (Volman et al., 2006; Lahav et al., 2013).

The occupational therapy handwriting intervention in these areas was stated to improve handwriting performance skills which were visual motor integration skills (Berninger et al., 1997; Voman et al., 2006), cognitive approach (Robert et al., 2014; Waelvelde et al., 2017), motor skill approach (Denton, Cope & Moser 2006; Robert et al 2014; Waelvelde et al., 2017) and behavioral approach (Furman, 2006). However, there were few studies to support behavior approach to be effective in improving handwriting skills performance. Furthermore, there is limited evidence of the involvement of parents and teachers to escalate handwriting skills performance among children with special needs (Polatajko et al., 1995; Waelvelde et al., 2017). A very recent study suggested that occupational therapy intervention in handwriting should be integrated with the school curriculum and carried out in the school setting for optimum benefits for children with handwriting difficulties (Kadar et al., 2020).

## The Focus of Handwriting Intervention

Occupational therapy intervention programs for children focus on two dimensions which were legibility and quality (Capodiecici et al., 2018; Shih et al., 2018; Rosenblum, 2019). Handwriting legibility acquires visual and perceptual skills. Handwriting legibility comprises of letter formation, letter reversals, spacing, size, slanting of letters, and alignment (Lam et al., 2011; Tourigny, 2016; Shih et al., 2018). Meanwhile, handwriting quality consists of motor planning and executive functioning skills. Motor planning skills requires the right amount of pressure, good timing, correct muscle function, and perfect force to complete handwriting task (Overvelde & Hulstijn, 2011; Brossard-Racine et al., 2012). Executive functioning skills demand attention, inhibition, working memory, initiation, and behavior to perform handwriting activities (Overvelde & Hulstijn, 2011; Dea et al., 2019; Rosenblum, 2019; Duiser et al., 2020). Figure 1 summarises the OT handwriting intervention and its underpinning theoretical background.

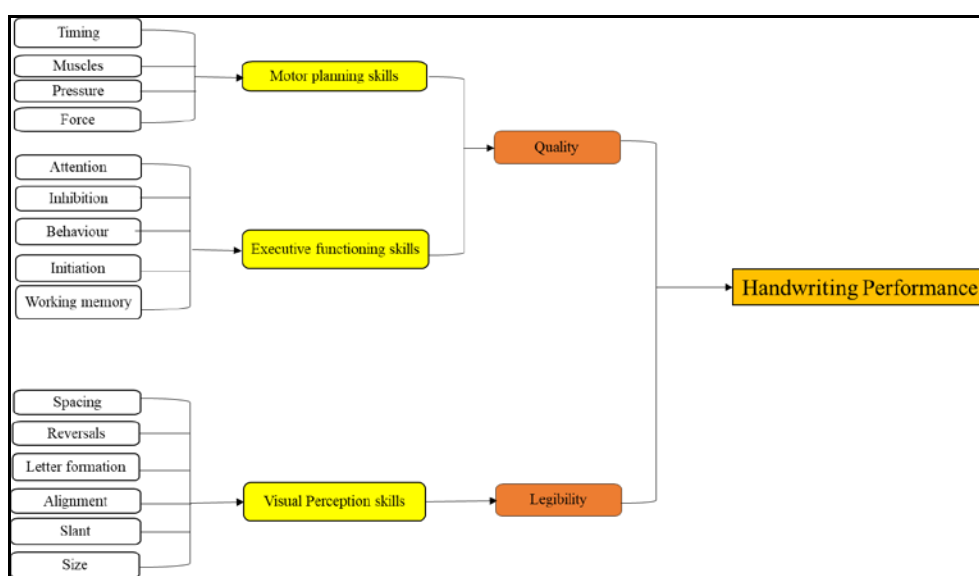


Figure 1. Summary of handwriting intervention underpinning theories

The handwriting intervention approach that has a positive impact on handwriting skills are sensory play skills, visual-perceptual-motor skills, adapted writing tools, and collaboration between occupational therapist, teachers, and parents in handwriting activities (Engel et al., 2018). These handwriting programs propose that handwriting

performance needs to address legibility and speed that are incorporated into the school curriculum (Engel et al., 2018). Based on this information on issues related to handwriting skills, the purpose of this study is, (1) to explore the need of developing a handwriting intervention guideline according to the Malaysian context of practice, (2) to construct a comprehensive handwriting intervention guideline, and (3) to investigate the effectiveness of the developed guideline for children's handwriting.

## **Method**

### **Need Analysis for Handwriting Intervention**

The analysis phase explored the need to develop an occupational therapy-based handwriting intervention guideline for children. Needs analysis ensured that there is a critical need to develop the guideline for handwriting intervention in the Malaysian context. The needs analysis phase in this study utilized a qualitative methodology using semi-structured interviews among school teachers, occupational therapists and parents (Polit & Beck, 2009; Chee, 2016). The justification to use the qualitative interview method was to explore experiences, perceptions and suggestions in practices that had paradigm value in the handwriting intervention (Restall et al., 2019).

### **Design and Development of a Handwriting Intervention Guideline**

The design and development phase is the second phase in this research. This stage was aimed to develop and validate the handwriting intervention guideline. The design and development phase produced a prototype or draft document that has not been tested for implementation and effectiveness. The main methodology at this stage was to obtain expert agreement on the content structure of the developed handwriting intervention guideline. This design and development phase uses a practical approach with a combined methodology of qualitative and quantitative methods (Shannon-Baker, 2016). Qualitative data collection was executed and followed by quantitative data collection. The method has two levels namely (1) focus group discussion (qualitative) and (2) Content Validity Index (CVI) score (quantitative). The CVI scores were performed with one round of validity after corrections were made following the focus group discussion (Polit et al., 2007).

### **Evaluation of handwriting intervention guideline**

The evaluation phase was to evaluate the effectiveness of the developed intervention guideline. The effectiveness phase used quantitative methods through the implementation of a cluster randomized control trial on treatment and control groups. Pre- and post- measures were taken before and after the intervention guidelines were given to all participants.

## **Results and Discussion**

The results were structured into the rationale of having an intervention guideline, the content structure, and the effectiveness of the intervention guideline to support children with handwriting difficulties. The discussion emphasizes the description of the handwriting intervention guideline including activity modules to guide clinical practice.

### **The Rationale for a Handwriting Intervention Guideline**

Three themes were derived from the interviews to highlight the need for a handwriting intervention guideline. The needs are: (1) to enhance children's potential in handwriting skills, (2) to provide comprehensive guidance for professionals, and (3) to synchronize practice in handwriting intervention among professionals. The themes are shown in Figure 2. The rationale is to increase the potential of children in handwriting skills by accelerating their motivation, reducing the risk of handwriting withdrawal, and assisting in technical aspects of handwriting performance. Furthermore, the rationale is to furnish professional practice such as therapists, teachers, and parents with a comprehensive and standardized guideline in handwriting intervention. Moreover, the rationale is to align intervention practice to establish a valid and reliable guideline with a holistic focus to address handwriting issues among children (Zainol et al., 2021).

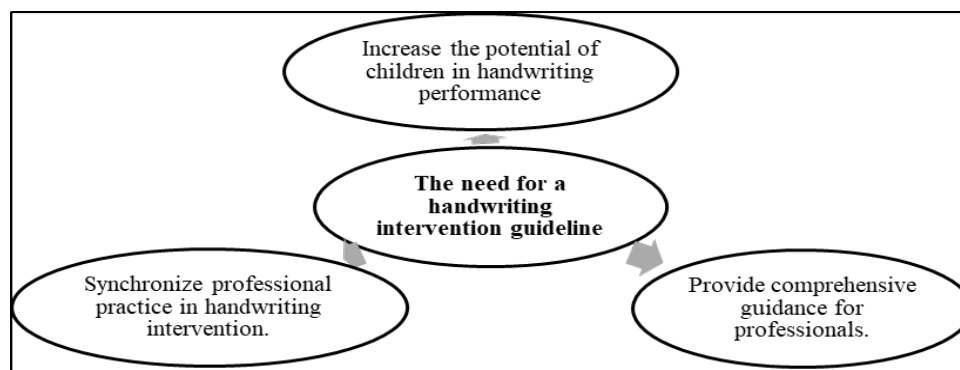


Figure 2. The need for a handwriting intervention guideline.

### The Content Structure of the Handwriting Intervention Guideline

The handwriting intervention guideline was designed and developed according to the established framework and model for children's handwriting performance (Chu, 1997; Roston, 2020). The guideline has five sections to navigate clinical practice in handwriting intervention. Section A is the introduction section. This section indicates the handwriting issues among children and theoretical occupational therapy solutions to address handwriting problems.

Section B encompasses the essential procedure for conducting handwriting intervention. It includes a principal guide in handling handwriting screening, assessment, planning, intervention, and evaluation procedures. Expert panelists agreed to simplify the procedure through a clear flow chart on conducting a handwriting intervention program from beginning to discharge. As this program will be used in Malaysia, experts agreed that the selected sentence for the copying skills activity during screening should use a sentence in the Malay language. The use of the national language of the intervention guideline provides a novel aspect in the development of a guideline for local commercial value.

Section C consists of handwriting readiness skill intervention. This section comprises handwriting development, pre-writing skills, and motor skills activities in preparation for handwriting. For this section, each of the intervention strategies is indicated accurately according to the children's developmental age. In addition, the section emphasizes the five handwriting skill phases: scribbling, imitation, tracing, copying, and writing from memory (Amundson, 2005). This section also includes motor skills activities. It was claimed that activities for gross motor skills should allow the therapist to perceive the child's level of sensory modulation (Danna & Velay, 2015), visual perception (Bara & Bonneton-Botté, 2018), and attention span (Palmis et al., 2017). It is suggested that the theoretical aspect and procedure of conducting gross motor intervention activities should be clearly defined (for upper and lower limbs). Therefore, the section provided with detailed diagram and explanation for each intervention activity. Moreover, this section included a variety of sensory-motor activities with multi-sensory materials to increase handwriting readiness skills (Chu, 1997; Woodward & Swinth, 2002; Taras et al., 2011).

Section D contains a depiction of the pragmatic approach to using correct handwriting tools, promoting functional pencil grasp, facilitating ideal posture and position, and demonstrating the best method of writing capitals, lowercase, and numbers. In this section, detailed explanations of a child's needs in handwriting intervention are described such as (1) the importance of proper sitting position, (2) the significance of using selected adaptive handwriting tools, and (3) the essence of intrinsic (motivation) and extrinsic (environmental condition) requirements during handwriting intervention. Specific information is structurally incorporated into the manipulation of handwriting tools in terms of its advantages and the criteria needed to allow the use of tools during handwriting activities.

The best explanation is on how handwriting strategies can differ for left-handed writers to guide practitioners in their intervention program. For example, left-handed writers can draw lines from right to left instead of the reverse (Olsen & Knapton, 2006). Furthermore, this section includes a manual to instruct letter formation activities with audio-visual (letter storytelling) techniques. The language used to describe pencil movements during letter formation activities is congruent with the proposed strokes. Moreover, safety precaution notes include at the bottom page of each intervention activity related to physical and motor movement.

Section E incorporates the entire program into a series of handwriting activities to be carried out with the children (a module-like version). This section had six sub-sections: (1) Development of Handwriting Skills Activities, (2) Pre-writing Skills Activities, (3) Gross and Fine Motor Skills Activities, (4) Writing Capital Letters, (5) Writing Lowercase Letters, and (6) Writing Numbers. In this section, the module highlights the importance of start and sequence during alphabet writing concerning intervention in the letter formation aspect (Olsen & Knapton, 2006). Overall, the handwriting intervention module represents the main objective of the entire handwriting intervention program.

To conclude, the construction of the handwriting intervention guideline is established at this stage. The proposed intervention domain such as handwriting readiness skills and handwriting skills intervention is recognized and re-arranged. Therefore, the content structure of the developed handwriting intervention guideline received excellent expert consensus.

### **The outline of handwriting intervention guideline**

#### *Practical Execution*

Each participant was given a handwriting intervention workbook after taking pre-assessment measures. The handwriting intervention guideline is set up to be applicable for children aged four to nine years. The study involved forty-two children with clearly defined handwriting difficulties. The guideline is presented to support children with handwriting issues in terms of handwriting readiness and writing criteria specifically on capitals, lowercase, and numbers. The guideline has been implemented on a group of children with pre- and post-measures. The handwriting intervention workbook consisted of six handwriting modules (as explained in Section E) completed within 10 weeks with the occupational therapy facilitators. The therapist worked together with the participant on an individual or group basis. The module could be brought as home program material for parents and school programs for classroom intervention. The module's completion was monitored every week through text-messaging reminders to the therapist in charge.

#### *Materials*

The proposed strategies and material were mini-board and chalk for writing capitals and numbers and a double-lined board for practicing lowercase writing (Olsen & Knapton, 2006). Please see Table 1 for detailed weekly intervention outline activity in the module. The intended duration of fulfilling the handwriting intervention module was 30-60 minutes per session. Each participant was required to complete all activities in the module before proceeding to post outcome measures.

#### *Treatment Fidelity during the Intervention*

The execution of handwriting intervention guideline usability was supervised through the use of a treatment fidelity checklist. The treatment fidelity checklist was used to monitor the accuracy of the intervention provided based on the guideline. Occupational therapy facilitators had successfully adhered to the constructed treatment fidelity. The intervention activities offered in the guideline are systematic, consistent, and relevant to support goals in handwriting performance skills. All participants substantially completed intervention activities in the guideline. Therefore, this indicated a high level of child involvement in the implementation of the handwriting intervention guideline across the intervention period. The use of a treatment fidelity checklist highlighted that the intervention satisfies the recommended frequency of handwriting interventions (Hoy et al. 2011; Brevoort, 2018; Engel et al. 2018).

Table 1. Detailed weekly intervention outline activity in the module.

| Content Summary of Handwriting Intervention Guideline |
|---|
| Section A: Introduction to Handwriting Skills         |
| - Problems related to handwriting                     |
| - Factors in handwriting issues                       |
| - Suggested frequency for handwriting intervention    |
| - Target group  |

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Section B: Occupational Therapy Service Procedure for Handwriting Intervention

- Screening
- Checklist
- Assessment
- Planning
- Intervention
- Re-evaluation

Section C: Intervention for Handwriting Readiness Skills

- Handwriting development
- Pre-writing skills
- Gross motor skills activities
- Fine motor skills activities
- Motor visual skills activities

Section D: Intervention for Handwriting Skills

- Handwriting tools
- Pencil grasp
- Posture and position
- Hand dominance
- Writing capitals, lowercase, and numbers
- Handwriting speed

Section E: Handwriting Intervention Module

- Session 1: Development of Handwriting Skills Activities
  - Session 2: Pre-writing Skills Activities
  - Session 3: Gross and Fine Motor Skills Activities
  - Session 4: Writing Capital Letters
  - Session 5: Writing Lowercase Letters
  - Session 6: Writing Numbers
- 

### **Effectiveness of the Handwriting Intervention Guideline**

The effectiveness of using the developed handwriting intervention guideline was measured using a valid and reliable instrument. The outcome measure was assessed using The Print Tool (TPT) before the intervention began and after the intervention (Olsen & Knapton, 2006). The Print Tool assessed the overall handwriting performance of writing capitals, lowercase, and numbers. Overall, handwriting skill performance in both groups (treatment and control) showed improvement before and after the intervention period. This is not surprising because handwriting skill performance is influenced by (1) time (Waelvelde et al., 2017a), (2) daily routine activities (Coutinho et al., 2017), (3) other interventions (Montgomery & Zwicker, 2020), and (4) the physiological and physical maturity (Smits-Engelsman et al., 2018). Nevertheless, the handwriting performance in the treatment group was significant after the intervention using the guideline as compared to the control group (using natural occupational therapy intervention). In this research, the effect of developmental maturation and other intervention at the same time of the research duration might influence the outcome. However, there were some studies that reported that handwriting performance demonstrated negative improvement in the control group (Pfeiffer et al., 2015; Hunter & Potvin, 2020).

In supporting this research outcome on the effectiveness, both treatment (twenty-one children) and control (twenty-one children) groups were structured for handwriting skills interventions such as fine motor skills, visual motor, visual perception, and sensorimotor. On the contrary, the differences in the treatment group using the developed guideline were the arrangement of intervention activities that were more (1) systematic, (2) focused, (3) aligned with the child's current development, and (4) appraised the collaboration between parents, teacher, and therapist. In contrast, the control group used standard occupational therapy intervention without structured modules and guideline. However, both interventions supported the foundations of handwriting interventions with established theoretical and clinical knowledge.

### **Conclusion**

This article provides a description of a newly developed handwriting intervention guideline for occupational therapy service delivery in Malaysia. This depiction of handwriting intervention guidelines is expected to assist

occupational therapy practitioners in conducting handwriting intervention for children to suit our socio-cultural background and educational system. The guideline has proven its effectiveness to improve the performance of children handwriting performance. This research has implications for theory using an organized and structured research approach. The procedure in the approach outlined three fundamental phases, need analysis, design and development, and evaluation. The process involving each phase is sufficiently accomplished through the exploration of developmental needs, followed by content design approved by a certified panel of experts, and the determination of effective use of this guideline on children. In conclusion, the developed handwriting intervention guideline was aimed to focus on improving the legibility and quality of handwriting performance. Thus, with satisfactory handwriting performance, children would be able to optimize participation in the school curriculum.

## **Recommendations**

The limitation of this study was that the sample size was small (forty-two children). Thus, the results obtained cannot be generalized to a larger population. Suggestions for further research are the implementation of the experimental method with: (1) a greater number of participants, (2) comparison with other modules of intervention guidelines, and (3) longer intervention duration.

Besides, the limitation of this study is that it used only measurement instruments for handwriting skills performance. Therefore, the results obtained are limited to aspects of handwriting skills in writing capital, lowercase, and numbers only. Recommendation for future research is to support the measurement of handwriting performance with visual perceptual (i.e. Test of Visual Perceptual Skills-4) and motor skills performance (i.e. Movement Assessment Battery for Children version 2) (Jaikaew & Satiansukpong, 2019).

The limitation of this study was the neglect of the additional effects of other interventions (treatments) on participants during the research duration. The intervention given to participants may be contaminated with academic interventions from teachers and activities at home with parents. Recommendations for future research need to address the contamination factors of these interventions to improve the reliability and validity of the effectiveness result of this study.

Finally, the limitation of this study is the lack of adequate statistical analysis to detect the relationship of writing components between capital, lowercase, and numbers. The results analyzed in this study focused on the overall performance of handwriting. Thus, the recommendation for future research is to investigate the relationship or correlation between the scores in the handwriting components (Bara & Bonneton-Botté, 2018).

## **Scientific Ethics Declaration**

The authors declare that the scientific ethical and legal responsibility of this article published in EPESS journal belongs to the authors.

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## Declaration of Conflicting Interest

The authors declared no potential conflicts of interest with respect to the research and/or publication of this article. The authors report no declaration of interest. The authors declare that the research was conducted in the absence of any risk or harmful situation to both facilitators and children.

## Statement of Contributor Ship

MZ researched literature, involved in protocol development, participant recruitment and wrote the first draft of the manuscript. MK, NAR, FWY, and NAA supervised, reviewed, edited the manuscript, and approved the final version of the manuscript.

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