

THE EVALUATION OF “EFFICIENT WRITING” ON AUTISTIC STUDENT IN INTERVENTION CENTER

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ABSTRACT

Although most autistic students have difficulties in letter formation, studies on the development of autism writing skills are scarce. This study aims to evaluate the effectiveness of "Efficient Writing" on autistic students between 13 to 16 years old in an intervention center. "Efficient Writing" underpins the combination of Brain Gym and The Size Matter Handwriting Programme concepts. Only one autistic student who has severe handwriting difficulties was selected as the sample of this study by implementing the ABA design. Data was collected through repeated measurement of respondent's handwriting skill in terms of the neatness followed by documentation analysis and semi-structured interview. The result showed that respondent had made a significant improvement in handwriting. Respondent's handwriting remained neat even after the intervention had been withdrawn. The outcome also highlighted the importance of handwriting intervention among autistic students with dysgraphia.

Keywords: Handwriting, autistic student, intervention, neatness, brain gym

1. Introduction

Handwriting is the result of the integration of various coordination movements that depends on the visual perception and motor feedback of the sensory (Capellini et al., 2017). It involves the interaction of both sides of the brain hemisphere. Unfortunately, autistic students experience uneven activation on both sides of the brain while processing information due to the weakness in brain functioning. An executive function is a group of cognitive processes that control complex behavior, physical, emotional, and cognitive movements (Jones et al., 2018; Torske, Naerland, Oie, Stenberg & Andreassen, 2018). Such problems had caused various disabilities such as fine motor skills, visual perceptions, and deficits in motor visual coordination skills to encrypt the mastery of handwriting skills (Kushki, Chau & Anagnostou, 2011).

Dysgraphia referred to the inability to write clearly (Guerrini et al., 2015). In terms of the handwriting interventions, dysgraphia is related to the executive functions such as working memory (Rosenblum, 2016). It is obvious that the defective of executive functions among students affect the formation of writing, speed, and smoothness of handwriting (McCloskey et al., 2008). This is because working memory followed by adequate training is required in the early stages of treatment to increase the source of attention so that the information can remain in the long-term memory. Autistic student's problems are coupled

with the lack of teachers who specialize in this field. Consequently, autistic students are not getting proper guidance.

Most autistic students have difficulties in forming letters (Cartmill et al., 2009; Fuentes et al., 2009; Hellinckx et al., 2013; Henderson & Green, 2001; Johnson et al., 2013b; Myles et al., 2003). Autistic students rarely justify spaces between alphabets and words compared to normal children who are the same age as them (Fuentes et al., 2010; Johnson et al., 2013; Rosenblum et al., 2016).

In terms of the alphabet size, autistic students tend to write overly tall and wide cursive letters (Beverdorf et al., 2001). Problems attached with alphabet size might be due to cerebellar and basal ganglia dysfunction. According to Adak, Chaudhuri, and Blumenstein (2017), computer-based handwriting analysis explains that neatness is an "aesthetic property" that is related to the "beauty of appearance" of handwritten documents. Even though handwriting neatness does not have a direct influence on handwriting legibility it does affect individual satisfaction with handwriting legibility (Simpson, McCluskey, Lannin & Cordier, 2016).

Occupational therapists should focus and seriously take into account students' perceptual visual skills, visual-motor skills, motor planning and sequencing, bilateral coordination, hand-eye coordination, and other related skills while preparing treatment (Case-Smith & Schneck, 2015). However, the major problem of children with autism is impairment of working memory and accompanied by left hemisphere dysfunction. They need to be trained with Brain Gym interventions that could allow the integration of both sides of the brain hemisphere through visual-motor training, visual cue guidance, verbal cues as well as adequate writing and motivation training through a comprehensive Size Matter Handwriting program to help them build a long-term memory in writing precise and neat lowercase letters. Although there are studies that suggest that short term interventions focus on fine motor skills and visual motor skills are effective enough in improving handwriting skills among all categories of primary school students (Ohl et al., 2013), handwriting interventions study among autistic students is still limited (Asaro-Saddler, 2015; Finnergan & Accardo, 2018; Kuskhki, Chau & Anagnostou, 2011; Pennington & Delano, 2012). Therefore, we take the initiative to draft an intervention that combines Brain Gym dan The Size Matter Handwriting Program concepts. The treatment of "Efficient Writing" is carried out based on the principle of Bandura's social cognitive learning theory. Bandura's social cognitive learning theory defines that the principle of learning is through observation, reinforcement, and motivation as three major teaching guidelines to increase the attention needed so that the movement task information presented can remain in working memory. This study aims to evaluate the effectiveness of "Efficient Writing" on the autistic students between 13 to 16 years old in an intervention center.

The objectives of this study are:

- i. To identify the effectiveness of the "Efficient Writing" intervention on handwriting in terms of the neatness of autism with dysgraphia.
- ii. To identify the strengths and weaknesses of the "Efficient Writing" intervention.

2. Literature Review

Brain Gym is effective in improving the competency of handwriting skills in terms of the legibility, writing lower case letters on red and blue-line paper, and justifying space between alphabet and word (Ocampo et al., 2017). Brain Gym is an intervention based on the Theory of Educational Kinesiology, in another word, learning through movement. According to

Kirpichnikova (2006, p.2), body movement relies on brain function. Brain Gym can complete the transmission of information in the brain and subsequently optimize learning capabilities through simple coordination movement. For example, bilateral skill activities such as Cross Crawl can activate both hemispheres of the brain evenly. The activity involves the movement of both sides of the body which requires coordination movements of eyes, ears, hands, feet, and even the muscles. When both sides of the hemisphere and the four main parts of the brain (lobes) are activated, cognitive can be improved to smoothen the learning process.

Keinath (2005) found that Brain Gym exerts a positive effect on handwriting skills. The study involves 14 students in a primary school. The age of students ranges from 7 to 9 years. Throughout the treatment period, Brain Gym was instructed by teachers who are trained by researchers. Brain Gym workouts started with PACE for seven minutes per day. PACE activities involve Water, Brain Buttons, Cross Crawl and Hook-ups. Another six more Brain Gym exercises were also conducted at least once on the same day when the students began to feel tired or unable to concentrate on tasks. The results showed that 12 respondents of the treatment group were able to write more alphabets in 20 seconds in The Handwriting Skill test.

Amtonis and Fata (2014) found that Brain Gym can improve cognitive function among elderly with poor working memory. The study by Amtonis and Fata (2014) involves a total of 18 seniors aged 65 and over. The respondents were instructed to perform Brain Gym exercise for 20 minutes every morning for 3 weeks. Among the Brain Gym exercises performed include Cross Crawl, Lazy 8, double doodles, owls, hand activation, leg waving, gravity gliding, pairs of horses, water, and brain button. The results showed that the respondents' cognitive function increased in terms of the place recognition, time, number counting skills, memory, and concentration.

According to Diana, Mafticha, and Adiesti (2017), regularly performing Brain Gym can stimulate the brain resulted in the improvement of hand-eye coordination skills which is essential to improve gross motor and fine motor skills among students aged 4 to 6 years.

Other than improve cognitive function, Brain Gym can help a person calmer emotionally. Dustow (2007) showed that an autistic student who practices Brain Gym for 30 days continuously was able to reduce behaviour problems such as screaming and crying. As such, it is suitable to be practiced among autism with dysgraphia.

The Size Matter Handwriting Program is the most comprehensive and effective handwriting intervention for students with learning difficulties. (Pfeiffer et al., 2015). It was planned using a pupil-centered explicit teaching method that underpinned cognitive theory, motor learning theory, and motivational theory (Moskowitz, 2009). The principle of Motor Learning Theory is implemented through incorporating practice and repetition into program materials as well as in daily life. The principle of Motivation Theory is incorporated through colourful, fun, and engaging activities. While cognitive principles are incorporated into the direct instruction of explicit letter formation techniques with consistent, meaningful terminology. Children learn the importance of letter size at different stages. The Size Matter Handwriting Program suggests teachers motivate his or her students by incorporate meaningful learning activities and rigorous objectives in teaching based on student needs as well as modify their teaching methods according to students' achievement level. This will assist them to master writing skills in terms of forming the legible alphabet letters. The Size Matter Handwriting Program Intervention uses explicit teaching sessions, correction, and self-assessment, verbal feedback with visual motivation (Pfeiffer et al., 2015). In addition, The Size Matter Handwriting Program Intervention also supports the development of handwriting skills in a linear sequence, begins with precise alphabet formation, placement of alphabet writing on lines, and able to justify the spaces between alphabets.

According to Pfeiffer et al. (2015), SMHP interventions can improve the handwriting skills of preschool students, first-year students, and second-year students. The study by Pfeiffer et al. (2015) involved students from two schools, one of the schools located in the Massachusetts Metropolitan area and another in rural New York. The treatment group received teaching sessions of 20 minutes per session for five days a week for 40 days. They are guided to review the alphabets they have learned each weekend. The alphabet taught is based on the size of the alphabet. Lower case letters such as "b" and "d" are taught separately at different times to avoid confusion. The intervention began with the teaching of 8 key concepts. A dice-rolling game was conducted to determine the frequency of writing exercises. The cue guidance given to each class is different, the alphabet was introduced based on the needs of the students in that class while the three-lined paper was used for writing practice purposes. The results showed that there were significant changes in the handwriting of the students in all three experimental groups.

After a year, Zylstra and Pfeiffer (2016) once again proved that SMHP handwriting interventions are effective in improving handwriting skills. The study aimed to evaluate the effectiveness of handwriting interventions administered by occupational therapists. The experimental group that received the intervention consist of preschool special education students that received an individualized instruction plan (IEP). The intervention was given every two weeks with a total of 30 sessions over 16 weeks. Two alphabets were taught in each session. The participated occupational therapists have experienced therapists who have 25 years of work experience averagely. The results showed that SMHP intervention can improve students' handwriting skills and is suitable to be performed in classroom teaching. In this study, we modified some of the concepts of The Size Matter Handwriting Program and combined it with Brain Gym into "Efficient Writing" to meet the need of autistic students with dysgraphia.

3. Method

3.1 Research Design

In this study, the ABA design of single-subject design was used to identify the effectiveness of the "Efficient Writing" intervention on the neatness of the handwriting of autism with dysgraphia. A" represents the basic or baseline phase. In this phase, the baseline is recognized for dependent variables while "B" represents the treatment phase. The treatment phase will initiate and perform for a length of time until consistency is found in the target skill or behaviour (dependent variable). The treatment is then can proceed to the third phase of "A", which is also known as the basic phase. The assessment given in the third phase is the same in the first phase, the test terminated once the result is stable.

3.2 Sample

The objective of this study was to investigate the effectiveness of "Efficient Writing" among the autistic students between 13 to 16 years old with severe handwriting difficulties. Therefore, the purposive sampling method is used to ensure the most suitable sample for this study was selected. The sample was chosen from an intervention center in Seberang Perai Tengah based on the students' individualized educational plan and development progress report. Few criteria were used to filter out the most suitable sample from a population. First, the sample selected must be able to understand the teacher's instructions and able to aware of when his or her name is called. Next, the sample should be an autistic student who is still facing word copying difficulties and unable to write 80% of the lower-case letter in legible form although have exceeded the age of 12 years old. Lastly, the sample

should have both sides of his or her finger and wrist that can function well on the table. Based on these criteria, only one sample was selected and the selected sample was given the nickname Chong in this study.

3.3 Instrumentation

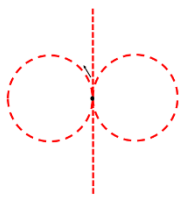
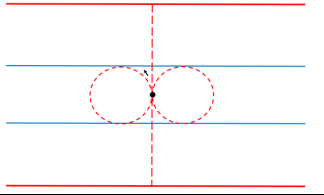
A formal test paper had been adapted to be used as pre test and post test to identify the students' existing knowledge before treatment was given and the retention of students' handwriting skills after the treatment. The assessment paper only involved components that were important for handwriting skills. The respondent was required to copy some of the syllables he had learned on the four-lined paper in the test paper. The test paper was extracted from the Year 2 3M Malay Basic activity book (learning disabilities) based on the standard curriculum of primary school.

The scoring rubric for the assessment of handwriting skills in terms of the neatness of handwriting is the same for formal assessment and informal assessment. According to Keifer (2015), the direction or sequence of writing, the point of overlap (closure of circle shape and accuracy of straight lines) and the type of line (alphabetical component) should be prioritized. Due to the validity of the assessment rubric has never been studied in Malaysia, we adapted the scoring rubric for the handwriting skills instrument which was designed by Cori (2015), who is a kindergarten teacher and an author of Mrsbsbeehive.com. Besides, Cori (2015) also emphasized that all letters were written must touch the lines of the paper at the correct point. This is also emphasized in the The Size Matter Handwriting Program. The purpose of this concept is to identify the effectiveness of the "Efficient Writing" intervention on handwriting skills in terms of neatness on four lined paper. Full marks for each letter are four. The total assessment marks obtained by the respondent will be divided by the maximum total marks and then multiplied by 100%. The scores are recorded in percentage in a table and being interpreted in the form of a line graph for visual inspection. The data were then supported by the result of the document analysis based on the respondent's handwriting on the pre test and post test paper.

3.4 The Procedure of the Intervention

In this study, the planning schedule of the three phases is as follows.

Phase 1 (one week)	Phase 2 (6 weeks)	Phase 3 (one week)
Repeated measurement for pre-test.	1 st week to 6 th week 1 st slot Brain Gym: Cross Crawl, Lazy 8 and visual motor skills activities. 2 nd slot Handwriting practice on blank A4 paper with Alphabet 8s printed on it (see Figure 1). <i>Figure 1: Laminated blank A4 paper with Alphabet 8s printed on it</i>	Repeated measurement for post- test.

	 <p><u>3rd</u> <u>slot</u></p> <p>Handwriting practice on four lined paper with Alphabet 8s printed on it (see Figure 2).</p> <p><i>Figure 2: Laminated four lined paper with Alphabet 8s printed on it</i></p>  <p><u>4th slot</u> Rewrite the same letter in the air. The reading syllabus started with the letter learned based on pictures.</p>	
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There will be 30 sessions of treatment provided in the intervention. Each session consists of four slots which take 60 minutes. The main activities selected from Brain Gym to be carried out in this study were Cross Crawl, Lazy 8, and Alphabet 8s. Bandura's social cognitive theory acts as a key teaching step in the "Efficient Writing" intervention. Each intervention session is delivered based on the learning principles of Bandura's cognitive social learning theory which relies on the four processes in sequence. Each activity begins with a Brain Gym exercise (motor visual coordination movement) to draw the student's attention to observe the demonstration, followed by a repetition exercise of the letter formation on the four-lined paper demonstrated by the model. Guidance supported by coloured and visual cues learning aids such as the use of Alphabet 8s is provided to increase their focus to strengthen their memory on how to form lowercase letters in correct manners and neat sequence. Next, the model was then demonstrated, the letter was written on the laminated paper printed with alphabet 8s on four coloured lines (red-blue-blue-red). The respondent was then trained to write the same lowercase letter on it. After that, reinforcement activities such as reading the syllabus based on pictures are intended to strengthen students' memory of the lowercase letter shapes learned. Finally, feedback and motivation such as praise and stars are given before, during, and after writing exercises serve to correct mistakes and encouraged movement so that the information to be conveyed can remain in the student's memory. Chong was required to write letters taught in a four-lined exercise book after returning home under parental guidance. The informal assessment was carried out based on the respondent's handwriting on the teaching material (laminated A4 paper printed with Alphabet 8s) and the four-lined exercise book.

3.5 Data Analysis

The pre-test was given in phase one and the post-test was given in phase three. Treatment started in phase two, repeated measurement on handwriting neatness was carried out until the data collected are consistent. During the treatment period, quantitative data was collected from informal assessment during the treatment period based on the respondent achievement in percentage and then interpreted into a line graph for visual inspection. The data were supported by the result of the document analysis based on the respondent's handwriting on pre-test and post-test paper and the semi-structured interview data from the teacher who has conducted the "Efficient Writing" during the treatment period to gain her perspective on the effectiveness of the intervention.

3.6 Results

Figure 3: Analysis of Chong's handwriting skill in terms of neatness

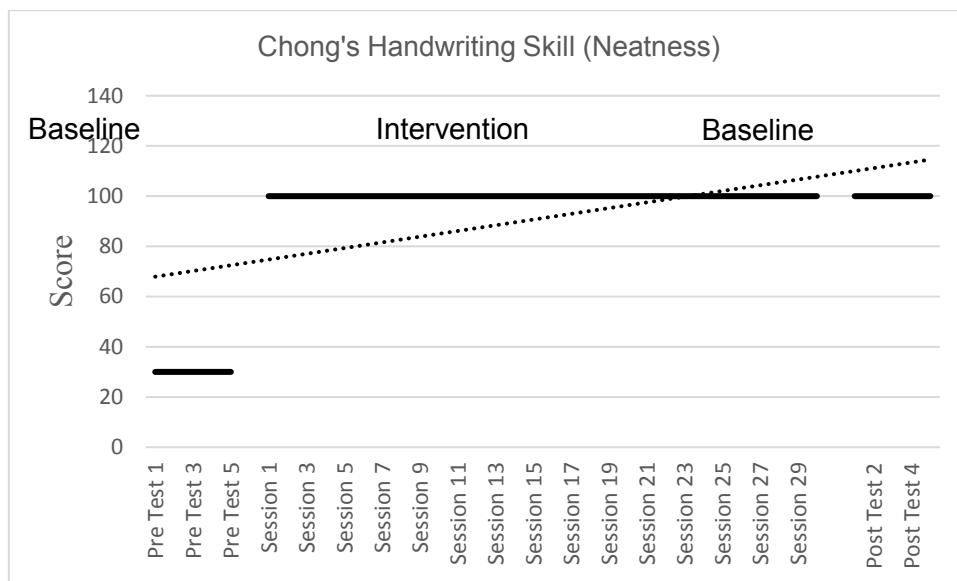
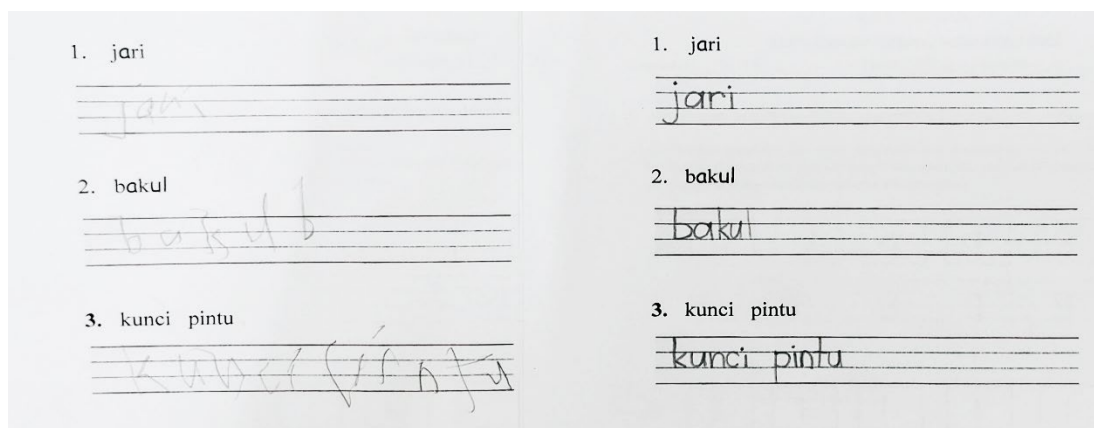


Figure 3 shows data analysis of Chong's handwriting skills in terms of the neatness of handwriting. There was a significant increment in Chong's handwriting skills throughout the three phases in this study. As soon as the intervention started, Chong's handwriting skills improved from 30% to 100%. Chong's score was maintained at 100% even though the treatment had been removed in phase 3.

Figure 4: Chong's pre test and post test paper



As shown in Figure 4, Chong could write lower case letters in equal size neatly in the four-lined paper in his post-test paper.

4. Discussion

The results of the analysis show that explicit teaching allowing teachers to modify teaching techniques based on specified objectives is effective in improving the handwriting skills of the autistic students with dysgraphia. Through explicit teaching accompanied by visual cue guidance and verbal feedback, the respondent can write lowercase letters on four lined paper neatly. The result aligned with the study conducted by Pfeiffer et al. (2015) who had proven that SMHP interventions can improve handwriting skills. Additionally, this intervention also can be incorporated with verbal stories to act as a reminder of the sequence of the letter formation which could assist the respondent to write correctly and neatly on four lined paper. According to the teacher who conducted "Efficient Writing" during the treatment period, Brain Gym activities also exert a positive effect on the respondent's working memory. Chong was able to form letters according to the sequence inconsistent size on the four-lined paper after the treatment. The reinforcement activities through dice rolls had successfully maintained the respondent's interest to continue to practice handwriting. Chong became more enthusiastic and confident when his writing was given stars by the teacher.

The only weakness of this intervention is the time allocated for each slot varies from being extended or shortened based on the respondent's progress. It is suggested that the respondent be provided a video prepared by a trained teacher. Whereby he can practice at home under the parent's guidance. This will increase the effectiveness of the "Efficient Writing" intervention. Therefore, the parents must play an important role by giving full attention and support to make "Efficient Writing" a success. Besides, the teaching materials used for letter formation during the treatment are very effective. However, the teaching material used for visual-motor skill training such as the basketball should be changed to plastic ball based on the respondent's ability when necessary.

The findings of this study are expected to be used as a guideline, especially for teachers, parents, and the ministry. The ministry can disclose the relevant knowledge to trainee teachers who are going to graduate or prepare to teach the autistic students. Other than that, the ministry can also provide training and share the knowledge through workshops and courses to teachers who teach in day schools or primary classes so that consistent methods can be used to optimize the learning experience. In this regard, teachers who teach in the premier classes in day schools should be exposed to the teaching methods of "Efficient Writing".

5. Conclusion

This study not only highlighted the strengths of the intervention but also contribute suggestions for improving the handwriting intervention among autistic students with dysgraphia guided by teachers and supported by parents.

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