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I will Stroke: Fine Motor Related Interventions and Hand Exercises in Enhancing Pencil Handling, Grip and Attitude of First Grade Schoolers

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ABTRACT

Nurturing fine motor skills and handwriting abilities unlocks young learners' potential. Each stroke they make is a step towards future success. Handwriting is a crucial skill that significantly impacts students' overall abilities. This study aimed to assess the effectiveness of interventions focused on pencil handling, grip, and fine motor skills in improving handwriting among first-grade learners at San Lorenzo Ruiz Educational Institute Inc. The study utilized a mixed-method research design. The quantitative part employed a one-shot case without a comparison group, while the descriptive-qualitative part analysed and interpreted pupils' responses and written outputs after the intervention. The study included 13 grade 1 learners who received Fine Motor Activities (FMA) and Hand Exercises (HE) interventions alternately over a two-week period, followed by writing activities with Instructed Proper Pencil Handling and Grip (IPPHG). The intervention stage involved pre-test and post-test assessments of Motor Coordination using the Beery-Buktenica Developmental Test of Motor Coordination (Beery-MC), as well as pre-test and post-test attitude assessments towards handwriting. The results revealed that the intervention had a positive impact on the pupils' attitudes towards handwriting and improved their post-motor coordination scores. The quantitative findings suggest that utilizing FMA and HE with instructed PPHG can enhance learners' attitudes towards handwriting, pencil handling and grip, and motor skills, particularly fine motor skills, with a large effect size. Based on the progress marks, it indicates limited progress initially, followed by moderate progress, and eventually excellent progress towards the end of the ten-day period of intervention. Similarly, the qualitative results along thematic analysis showed that improved pencil grip, enhanced writing skills, enjoyment and engagement, and positive attitude towards writing and coloring emerged. In like manner, based on the qualitative analysis of pupils' writing outputs, the learners have improvements in their handwriting skills, specifically in the areas of letter spacing, speed, and reducing errors in stroke formation. These improvements indicate progress and development in their overall writing abilities. Therefore, the use of IPPGH, FMA, and HE can effectively develop the handwriting skills and attitudes of learners. This study serves as a guide for the implementation of new policies aimed at improving writing readiness among first graders.

Keywords: *Pencil Handling, Pencil Grip, Fine Motor Skills, First Grade Schoolers, Manual Dexterity, Intervention, Handwriting*

INTRODUCTION

Handwriting skills are crucial for the global skills of students. Writing which is a fundamental skill that is required in many professions. Proficient handwriting skills are indispensable in diverse professional domains, including medicine, law, and business. Doctors need to accurately write prescriptions and take notes during consultations, while lawyers must draft well-written briefs and legal documents. Additionally, employees in the business world often need to write detailed reports and professional emails. In the academe, where the life and blood of scientific engagement is scholarly writing. If children are unable to develop the necessary fine motor skills in their fingers to effectively grip and manipulate a pencil, they may encounter difficulties with writing and other tasks that rely on precise hand movements. This can have long-term implications, potentially impacting their future employment opportunities and limiting their career options.

Early development of fine motor writing skills is increasingly acknowledged as a critical aspect of school readiness, strongly linked to future academic achievements (Swenson, 2019, Escolano-Pérez, Maria Luisa Herrero-Nivela, & Losada, 2020, Eva Ose Askvik, Van, & Audrey, 2020). By emphasizing the importance of handwriting, education systems contribute to holistic student development, nurturing well-rounded individuals who can actively participate in their communities and preserve cultural legacies, thereby promoting the ideals of the Sustainable Development Goals (SDG) 4 and UNESCO's vision of a more inclusive and diverse world. Handwriting goes beyond the mere act of writing, it plays a crucial role in cognitive development, fine motor skills, and overall literacy (Dinehart, 2015, James, & Engelhardt, 2012, Ray, et al, 2022).

In academic, interpersonal, and professional communication, handwriting is a motor skill frequently used. Paper and pencil exercises take up 42% of class time, with the percentage rising as students move through the grades (Dineheart, 2015). Enhancing pencil handling and grip among first-grade schoolers is crucial for their development of fine motor skills and successful handwriting. Proper pencil handling and grip enable students to have better control over the pencil, leading to more precise and legible writing. Manual Dexterity (MD) is the capacity to use the hands in a coordinated way to grasp and manipulate objects as well as to execute precise movements that have a significant impact on academic skills (such as handwriting) and daily functional activities (Fuelscher et al, 2018). Handwriting proficiency not only enhances academic skills such as written expression and comprehension but also contributes to daily functional activities.

Why Handwriting Difficulty is a Global Concern?

Organizations such as UNESCO, WHO, and AOTA acknowledge the barriers to education and development that children with learning difficulties encounter, including the specific challenges they face in handwriting. Handwriting is a complex task that involves the interaction of lower-level perceptual-motor processes and higher-level cognitive processes, enabling the communication of thoughts through written language (Smits-Engelsman & Verbecque, 2022; Santangelo & Graham, 2016). Proficient handwriting is crucial for full participation in classroom activities, as children spend a significant portion of their time engaged in paper and pencil tasks (Pascual, 2023). Challenges related to graphomotor skills, such as handwriting difficulties, can significantly influence a child's academic achievements and self-confidence (Ralli, Chrysochoou, Giannitsa, & Angelaki, 2022). Writing difficulties are prevalent among a substantial portion of the child population, affecting around 10-30% of children, particularly those with conditions like ADHD, learning disabilities, and speech and language difficulties (Rocha, Castro & Limpo, 2022). Dysgraphia, which encompasses challenges in spelling and handwriting (both print and cursive), is commonly used to describe this disorder of written expression (Kunhoth, Al Maadeed, Saleh, & Akbari, 2023). Children with dysgraphia often struggle to make progress in their handwriting skills, even with adequate instruction and practice (Hen-Herbst & Rosenblum, 2022). Their handwriting exhibits inconsistencies in size, form, and orientation across multiple attempts. Dysgraphia goes beyond the physical act of writing, impacting various cognitive processes involved in letter

formation, spelling, and overall written expression.

Difficulties on the Handwriting Skills of First Graders During and in the Post-COVID 19 in the Philippine Setting

Handwriting difficulties among first graders in the Philippines have been a topic of concern, particularly due to the transition from pre-writing skills to actual handwriting. Handwriting proficiency is crucial for first-grade students as they embark on the journey of acquiring reading and writing skills. However, some first graders may experience difficulties with their handwriting skills most especially during and in the post-COVID pandemic. Factors that have contributed to the difficulties of Grade 1 learners are attributed to the following: (1) limited in-person instruction by the teachers, there was also a reduced fine motor activities due to restrictions and limited outdoor activities of the children, (2) the increased screen time where the increased reliance on digital devices for remote learning and entertainment during the pandemic has resulted in prolonged screen time for many first graders, and lastly, (3) the transition to remote or blended learning models during the pandemic has made it challenging for teachers to provide individualized support to students with handwriting difficulties.

In the post-COVID 19 era, with the shift towards online learning and remote education, students are required to engage with digital media more than ever before. This led to a further decline in the development of fine motor skills required for handwriting grip (Lin, et al, 2022). The excessive use of technology such as touchscreen phones and tablets can prevent children's finger muscles from developing sufficiently to enable them to hold a pencil correctly (Lin et al 2022). If not properly addressed, this may lead to children struggling to hold pens and pencils, which is a fundamental skill required in many professions (Seo, 2018). The lack of fine motor skills may affect their future job prospects and limit their career choices. Additionally, the nature of play has changed, and it is easier to give a child an iPad than encouraging them to do muscle-building play such as building blocks. Therefore, children need lots of opportunities to develop the fine muscles in their fingers that are required to grip a pencil and move it.

This problem was supported by Sally Payne, a Pediatric Occupational Therapist, who noted that children entering school are increasingly unable to grip pencils due to a lack of basic movement abilities (Hill, 2018). Excessive reliance on touchscreen devices such as smartphones and tablets has resulted in challenges for children in gripping pens and pencils effectively. The overuse of these devices is preventing children's finger muscles from developing sufficiently to enable them to hold a pencil correctly. It was averred that children need lots of opportunities to develop the fine muscles in their fingers that are required to grip a pencil and move it. While specific research data on the prevalence of handwriting difficulties among Filipino first graders is limited, studies from other countries suggest that a significant percentage of children struggle with handwriting. For example, a study conducted in Iran found that the prevalence of handwriting difficulties among school children was 34%, with 67% of boys and 33% of girls affected (Khan & Sharma, 2020). Another study found that the prevalence of handwriting problems in children from 6 to 12 years ranges between 12% and 33% (Margo van Hartingsveldt, et al, 2015). Moreover, research has shown that the accuracy of hand and in-hand manipulation skills is a factor that affects handwriting legibility (Seo, 2018). The study revealed that there is a high level of correlation between fine motor skills and handwriting legibility. Poor quality of handwriting is a common issue among children with handwriting difficulties (Ray, et al, 2022). Therefore, there is a need for additional research to evaluate the effectiveness of direct fine motor interventions on handwriting skills. It is necessary and important to address handwriting difficulties in first graders as they can impact their academic performance and future success.

Pencil Handling and Grip for First Grade Schoolers

Pencil handling refers to the ability of first-grade schoolers to hold and manipulate a pencil effectively and efficiently while writing or engaging in fine motor activities (Breuhl, 2016). It encompasses aspects such as the grip style, finger positioning, and overall control of the pencil. Proper pencil handling involves adopting an appropriate grip, such as the tripod

grip, which involves holding the pencil between the thumb and index finger with support from the middle finger. It also includes maintaining a relaxed and comfortable hand posture while using the pencil. Pencil grip specifically refers to the way a student holds the pencil with their fingers. It focuses on the placement and alignment of the fingers on the pencil (Lin et al, 2017). The tripod grip, which is considered the ideal grip, involves holding the pencil between the thumb and index finger, with support from the middle finger. This grip allows for controlled movements and precision while writing. By considering and addressing pencil handling and grip in educational practices and interventions, educators and parents can provide the necessary support for first-grade schoolers to develop strong fine motor skills and achieve success in their handwriting tasks. Promoting an appropriate grip style, such as the tripod grip, allows first-grade schoolers to have better control, enhance fine motor control, support handwriting fluency, reduce fatigue and strain, and ultimately improve the legibility of their written work. By providing guidance and targeted interventions, educators and occupational therapists can effectively enhance pencil handling and grip skills in first-grade schoolers, setting a strong foundation for their handwriting development and overall fine motor skills.

Relationship between fine motor skills and handwriting performance

Limited research exists on the correlation between fine motor skills and handwriting performance in school-age children, as well as the impact of pencil size on the legibility of handwriting (Weil & Cunningham, 2014). Further exploration of these connections can enhance our knowledge and guide educational strategies and interventions to enhance children's handwriting skills.This knowledge can assist educators and occupational therapists in developing targeted interventions and selecting appropriate writing tools to support optimal handwriting development in school-age children.Fine motor skills are the ability to make movements using the small muscles in our hands and wrists. They involve the coordination of the hands and fingers and are necessary for performing most of the tasks in life (Belsky, 2019). Fine motor development involves the manipulation and control of the smaller movements of the fingers, hands, wrists, feet, toes, mouth, and tongue. Developing fine motor skills is important for accomplishing activities of daily life, skills that include buttoning, zipping, grasping, pinching, squeezing, and tying. Early childhood programs frequently include activities that support development of fine motor skills including painting, drawing, coloring, writing, cutting, gluing, handling manipulatives, and selfcare tasks such as dressing, undressing, zipping, fastening, tying, and feeding (Dinehart & Manfra, 2013; Huffman & Fortenberry, 2011; MacDonald et al., 2016; Rule & Stewart, 2002).

Further investigation is needed to understand the specific connections between fine motor abilities and handwriting outcomes, as well as the impact of different writing tools on legibility. Moreover, there is a clear need for additional research to evaluate the effectiveness of direct fine motor interventions on handwriting skills. This includes exploring interventions that specifically target the development and improvement of fine motor skills to enhance overall writing abilities. Additionally, studying the effectiveness of physical education-based assistive intervention programs in improving both fine motor skills and writing skills among first-grade schoolers would provide valuable insights (Fuelscher et al., 2018). Such research would contribute to the development of evidence-based strategies and interventions for promoting optimal handwriting proficiency among children. By addressing these research gaps, will provide a deeper understanding of the relationship between fine motor skills and handwriting in the Philippine context which is seen as an unexplored phenomena, this will also identify effective intervention approaches, and inform educational practices that support the development of legible and proficient handwriting in school-age children.

The Importance of Foundational Skills in the K-12 Curriculum for Handwriting Readiness

The K to 12 Basic Education Program in the Philippines places a strong emphasis on the development of foundational skills, including fine motor skills, during the early grades. DepEd Order No. 13, s. 2018 provides a framework that indirectly contributes to students' readiness for handwriting by incorporating activities and exercises within

the curriculum that support their handwriting development in Grade 1. In like manner, the Early Childhood Education (ECE) curriculum, which is a part of the K to 12 programs, encompasses various learning domains, including fine motor skills. These skills play a vital role in preparing students for handwriting readiness. By incorporating activities that promote the development of fine motor skills, such as finger exercises, hand-eye coordination tasks, and manipulation of small objects, the curriculum indirectly prepares students for the physical dexterity required in handwriting.

Problem Diagnosis and Context of the Study

The study identified a practical gap in the context of San Lorenzo Ruiz Educational Institute Incorporated, a private archdiocesan school in the Municipality of Lasam, Cagayan, where Grade 1 learners were observed to have difficulty in mastering proper pencil handling and grip, which is a fundamental skill for their academic progress. The Grade 1 pupils of the SY 2023, who were preschoolers during the COVID 19 pandemic, experienced a disruption in their early learning and development. Due to limited access to in-person schooling and reduced opportunities for hands-on activities, they are now struggling to develop their fine motor skills essential for writing. In the assessment conducted before the study, it was confirmed that proper pencil handling and grip were among the least mastered competencies of Grade 1 learners. The gap analysis conducted by the researcher in consultation with her advisers as part of the problem diagnosis is presented in the Table 1, the gap analysis reveals several areas where first-grade pupils in SLREI are struggling with their handwriting readiness. Shows the need for intervention to address these challenges and enhance the fine motor skills required for successful handwriting.

As presented in the initial data gathered prior to the conduct of the intervention, out of the observed 15 pupils, only one has mastered the correct pattern of writing, indicating a significant gap in their ability to write from left to right and top to bottom. Additionally, five

Table 1. Actual Problem Diagnosis of the Practical Gap (N=13)

What Should Be?	What is Actual?	What is the Gap
First graders should start writing from left to right and top to bottom	14 first graders have mastered the correct pattern in writing	Among the 15 pupils, only 1 first grader is still mastering the correct pattern in writing
Children in first grade understand the rule of capitalization	Only 10 first graders knew when to use capital letters in constructing a sentence	5 first graders do not know and still do not understand when to use capital letters in constructing a sentence
First graders handle writing tools correctly (proper pencil handling and grip)	Only 2 first graders have proper pencil handling and grip	13 first graders have improper handling of writing tools
First graders can trace, copy, or write different strokes	13 first graders can properly trace, copy, and/or write different strokes	Among the 15, only 2 first graders do not have good writing skills, especially when it comes to writing words
First graders can form letters correctly and legibly	Only 4 first graders consistently form letters correctly and legibly	11 first graders struggle to form letters correctly and legibly
First graders demonstrate proper letter spacing and alignment	None of the first graders consistently demonstrate proper letter spacing and alignment	All 15 first graders struggle with maintaining proper letter spacing and alignment
First graders use appropriate pressure when writing	Only 3 first graders apply appropriate pressure when writing	12 first graders have difficulty in applying appropriate pressure when writing
First graders write with proper letter size and formation	Only 5 first graders consistently write with proper letter size and formation	10 first graders have challenges in maintaining proper letter size and formation
First graders demonstrate consistent line placement and spacing	Only 3 first graders consistently demonstrate consistent line placement and spacing	12 first graders struggle with consistent line placement and spacing in their writing

Note: The gaps mentioned above are based on the observed performance of the 15 first-grade pupils in SLREI regarding their handwriting readiness duly validated by the cooperating teacher and the school principal.

students lack an understanding of capitalization rules, while 13 students have improper handling of writing tools and struggle with applying appropriate pressure when writing. Forming letters correctly and legibly is a challenge for 11 students, and none of them demonstrate proper letter spacing and alignment. Only six students can write their thoughts and ideas with clarity, and a minority consistently write with proper letter size, formation, and line placement. These gaps in handwriting readiness highlight the need for targeted interventions and support to improve fine motor skills, letter formation, spacing, and other crucial aspects of effective writing for these first-grade pupils. The lack of instructional materials and inadequate time allotted for learning processes further emphasized the need for interventions aimed at improving pencil handling and grip. To address this practical gap, the researcher designed and developed a Fine Motor Activity (FMA) Box for each respondent, along with Hand Exercises and instructed Proper Pencil Handling and Grip (IPPHG) before engaging in writing activities. The study aimed to assess the effectiveness of these interventions in enhancing the learners' handwriting attitude and motor coordination performance. By targeting these areas of concern, the study aimed to bridge the gap in proper pencil handling and grip skills among Grade 1 learners, providing them with the necessary foundation for successful handwriting and academic progress.

Objectivesof the Study

The study aimed to investigate the effectiveness of Fine Motor Related Interventions (FMA) and Hand Exercises (HE) in enhancing pencil handling and grip among first-grade schoolers at San Lorenzo Ruiz Educational Institute. Specifically, it sought to address the following: (1) assess the pre- and post-intervention attitudes towards handwriting among Grade 1 pupils; (2) determine significant differences in the pupils' attitudes towards handwriting before and after the intervention; (3) describe the pre- and post-intervention scores of the Beery-Buktenica Developmental Test of Motor Coordination among Grade 1 pupils; (4) determine significant differences in the pupils' scores on the Beery-Buktenica Developmental Test of Motor Coordination; (5) determine the ten-day progress marks of Grade 1 pupils with the implementation of FMA and HE interventions; (6) ascertain the difference in ten-day progress marks during the integration of FMA and HE; and (7) describe the ways in which the handwriting skills of the learners improved.

MATERIALS AND METHODS

Research Design

The study employed mixed methods research. The research design consisted of two phases: a quantitative phase (one-shot case study) followed by a qualitative phase (descriptive analysis of writing outputs and thematic analysis). The quantitative part was one-shot case study which is like a quasi-experiment only having no group to compare it with while the qualitative part focused on the descriptive analysis of the writing outputs of the respondents. By integrating quantitative and qualitative methods, the research design aimed to provide a comprehensive understanding of the effectiveness of fine motor related interventions and hand exercises in enhancing pencil handling and grip skills among first-grade schoolers at San Lorenzo Ruiz Educational Institute. The mixed methods approach allowed for a more robust and holistic assessment of the intervention's impact on the participants' fine motor skills development (Creswell & Plano Clark, 2017; Merriam, 2009). Figure 1 presents the research design framework of the study.

For the quantitative component, the single-shot pretest-posttest experimental research design was employed. It is a type of quasi-experimental design that involves only one group of participants, with both pre-test and post-test measurements taken after the experimental intervention (Creswell & Plano Clark, 2017).

In this study, the group of participants consisted of 15 grade pupils who received Fine Motor Activities (FMA) and Hand Exercises (HE) interventions alternately over a two-week period. Before the experimental intervention, a pre-test was conducted to determine the baseline handwriting skills of the participants.

Figure 1. Mixed- Methods Research Design Framework

Following the intervention, a post-test was administered to evaluate any progress or enhancement in their handwriting abilities. The qualitative component of the study involved conducting a descriptive analysis of the writing strokes demonstrated by the participants. The objective of this analysis was to comprehensively examine and understand the specific characteristics and patterns evident in their writing (Patton, 2015). By scrutinizing the written outputs, the study aimed to gain insights into the participants' handwriting skills and identify any areas of difficulty or improvement. Additionally, a thematic analysis of the unedited responses of the pupils was conducted to further explore the emerging themes and patterns within their feedback.

Sampling Characteristics

The study involved a total of 13 Grade 1 learners, comprising two males and eleven females, from San Lorenzo Ruiz Educational Institute. A purposive sampling technique was employed to select the respondents, taking into consideration the small population size of the institute. Purposive sampling, also known as judgmental or selective sampling, was deemed appropriate for this study due to its alignment with the research goals and objectives (Campbell, Greenwood, Prior et al., 2020). This sampling method allows for the intentional selection of participants who possess the specific characteristics or experiences relevant to the research topic who are manifesting pen handling and grip difficulty. In this case, the goal was to target Grade 1 learners from San Lorenzo Ruiz Educational Institute to examine the effectiveness of fine motor related interventions on pencil handling and grip skills.

Table 2. Profile of the Respondents

Profile Variables	Categories	Frequency (N=13)	Percentage
Sex	Male	2	15
	Female	11	85
Age	6 years old	9	69
	7 years old	4	31
Childs Handedness	Right-handed	11	85
	Left - handed	2	15

Table 2 presents an overview of the participants' demographics, including sex, age, and handedness. The table provides a breakdown of the respondents' distribution within each category, presenting the frequency and percentage for each group. Out of the total 13 respondents, 2 were male, comprising 15% of the sample, while 11 were female, representing 85% of the sample. These figures indicate a higher representation of female participants in the study. In terms of age, 9 respondents were 6 years old, accounting for 69% of the sample, while 4 respondents were 7 years old, making up 31% of the sample. This suggests that the majority of participants were 6 years old. Regarding handedness, 11 respondents were right-handed, constituting 85% of the sample, while 2 respondents were left-handed, accounting for 15% of the sample. These results highlight a higher prevalence of right-handedness among the participants. These findings shed light on the demographic characteristics of the respondents, underscoring the importance of considering sex, age, and handedness when designing interventions and interpreting the outcomes. It emphasizes the significance of tailored approaches to effectively enhance pencil handling and grip skills among first-grade students at San Lorenzo Ruiz Educational Institute.

Research Instruments

A. Pre-post Handwriting Attitude Questionnaire
The research utilized a pre-post Handwriting Attitude Questionnaire to evaluate the effectiveness of Fine Motor and Hand Exercises on the participants' attitude towards handwriting. The questionnaire consists of ten statements with 5 as the highest for "strongly agree" to 1 as the lowest for "strongly disagree." The questionnaire underwent validation and reliability testing to ensure its suitability for the study. The questionnaire was validated through a rigorous process involving content validity, where experts in the field of handwriting and motor skills reviewed and assessed the relevance and clarity of the questionnaire items. Additionally, the questionnaire underwent pilot testing with a small group of participants from a similar demographic to ensure its comprehensibility and appropriateness in the Philippine context. The Cronbach's alpha was utilized to assess its reliability. The Grade 1 pupils were presented with statements and asked to choose emoticons representing their agreement or disagreement: a smiling face for "strongly agree," a neutral face for "undecided," and a sad face for "strongly disagree." Emoticons enhanced engagement and comprehension, enabling young children to express their attitudes towards handwriting more effectively. This child-centered approach aligned with the research's focus on enhancing pencil handling and grip skills. By using visual and interactive tools, the questionnaire captured holistic assessments of pupils' attitudes, considering their motor and sensory experiences. This approach provided a comprehensive understanding of the interventions' impact on their overall handwriting experience.

B. Pre-post Beery-Buktenica Developmental Test of Motor Coordination (Beery-MC) Scores
The study utilized a pre-post test of motor coordination, specifically employing the Beery-Buktenica Developmental Test of Motor Coordination (Beery-MC). This test consisted of thirty items designed to measure the participants' motor assessment scores before and after the intervention. The Beery-MC is a widely recognized and extensively validated assessment tool specifically designed to measure visual-motor integration skills. It is commonly used in research and clinical settings to assess individuals' ability to integrate visual and motor skills effectively. The Beery-MC is designed to evaluate an individual's proficiency in coordinating motor skills during manual actions (Beery & Beery, 2006). It is a pencil-and-paper test that requires examinees to replicate a series of geometric shapes. The administration of the test typically takes around 10 to 15 minutes. Widely employed in both research and clinical settings, the Beery-MC serves as an assessment tool for appraising motor coordination skills in children with learning disabilities and developmental coordination disorder. Occupational therapists also utilize the Beery-MC to evaluate children's motor abilities and establish a baseline for their skill development. Scoring and transmutation of the test scores were conducted following the guidelines outlined in the Beery-MC manual. The reliability of the test was assessed using established guidelines and norms specific to the Beery-Buktenica VMI, a widely recognized and extensively validated assessment tool for measuring visual-motor integration skills. Psychometric testing has confirmed its reliability, and the manual provides scoring guidelines and interpretation recommendations. The research strictly adhered to the standardized administration procedures specified in the Beery-Buktenica VMI manual, and the teacher-researcher administered the tool to the respondents.

C. Progress Mark Checklist of the Fine Motor Skills
The study utilized a Progress Mark Checklist to assess and monitor the learners' progress during the implementation of the Instructed PPGH (Pencil Position and Grip Habits), Fine Motor Activities (FMA), and Hand Exercises (HEs). The checklist consisted of ten competencies expected to be demonstrated by first-grade learners. The checklist employed a rating system with marks such as "not participative," "coping," "emerging," "growing," and "meets expectation" to evaluate the learners' level of attainment in each competency. The indicators were adapted from Greutman's (2022) Fine Motor Skills Checklist for Early Elementary (Ages 6+). Before administration, the checklist underwent careful review and revision based on suggestions from

the research professor to ensure its effectiveness. Throughout the ten-day intervention period, the Progress Mark Checklist was used to assess and monitor the learners' progress in acquiring the targeted competencies. During the implementation of the Instructed PPGH, FMA, and HEs, the learners' performance in each competency was observed and evaluated based on the predefined rating scale. The marks assigned to the learners provided valuable insights into their development and progress in relation to the targeted competencies. By employing the Progress Mark Checklist, along with other research instruments, a comprehensive evaluation of the effectiveness of the Fine Motor Related Interventions in enhancing pencil handling and grip skills among first-grade schoolers at San Lorenzo Ruiz Educational Institute was achieved.

D. Teacher-Researcher Journal and Photo Documentation

The Teacher-Researcher Journal and photo documentation played a crucial role in documenting observations and reflections during the fine motor intervention study aimed at enhancing the pencil handling and grip of grade 1 learners. The journal entries focused on capturing the children's behaviors in the classroom specifically related to their pencil handling and grip skills. The Teacher-Researcher recorded detailed observations of the children's engagement levels, their participation in fine motor activities, their responses during writing tasks, and their progress in developing efficient pencil handling techniques. By systematically documenting these observations, the Teacher-Researcher gained valuable insights into the specific needs of each child and their progress over time. The Teacher-Researcher Journal was an essential component of the study, providing a detailed record of the children's behaviors, progress, and specific needs related to pencil handling and grip skills. It facilitated ongoing reflection, adjustment of intervention strategies, and a comprehensive assessment of each child's development in the targeted area. The teacher's journal was utilized to record the unedited responses of the pupils following the intervention. This allowed for the documentation of the pupils' genuine and unfiltered feedback and reflections on their experiences. By capturing their responses in an unedited form, the journal entries provided a direct and authentic representation of the pupils' thoughts and perspectives.

Ethical Considerations

The research conducted in this study obtained ethical approval from the Institutional Ethics Review Board (IERB) of Cagayan State University. The study adhered to strict ethical guidelines and considerations to ensure the protection and well-being of all participants involved. Firstly, permission to conduct the study was obtained from the research professor, the Principal of San Lorenzo Ruiz Educational Institute Incorporated, and the Grade 1 learners' adviser. This approval demonstrated a commitment to conducting the study in an ethical manner and upholding principles of research integrity. Secondly, Prior to the participation of Grade 1 learners in the study, the parents or guardians were sought for their consent. Informed consent was obtained, ensuring that they were provided with detailed information about the study's purpose, procedures, potential risks and benefits, and emphasizing that participation was voluntary. Ample opportunity was given for parents or guardians to ask questions and make informed decisions regarding their child's involvement. Among the 15 pupils' parents, only two did not grant permission for their children to participate, resulting in a total of thirteen respondents for the study. Thirdly, an orientation session was conducted by the researcher before the administration of research instruments. This session ensured that participants, including both learners and their parents or guardians, fully understood the study's objectives and procedures. This step promoted transparency and allowed participants to feel comfortable and well-informed about their involvement. Lastly, the study upheld the principles of data privacy by strictly maintaining the confidentiality and anonymity of the respondents. Personal identifying information, such as names, was not mentioned in any research documentation or reports. This practice ensured that the privacy and confidentiality of participants were respected, in line with the data privacy act and ethical guidelines.

Data Gathering Procedure

The data collection procedure in this study on fine motor interventions aimed at enhancing the pencil handling and grip of grade 1 learners spanned a period of three months, starting in January 2023 and concluding in March 2023. Prior to the intervention, a baseline assessment was conducted to determine the participants' initial pencil handling and grip abilities. This assessment involved observing the participants' pencil grip and their ability to manipulate the pencil effectively. Baseline data was collected for each participant, noting their individual strengths and areas for improvement.

Table 3. *Stages of Data Gathering Process*

Stages of Data Gathering	***Timeframe***	***Procedures***
Pre-Intervention Stage	January 2023	❖ Problem diagnosis stage using the Gap Analysis Tool *(in Table 1)* ❖ Observe participants' pencil grip and manipulation skills ❖ Record individual strengths and areas for improvement
Intervention Stage	February 2023	❖ Implement structured activities designed to enhance fine motor skills ❖ Hand-eye coordination exercises ❖ Finger dexterity exercises ❖ Pencil grasp technique practice ❖ Provide clear instructions to participants and facilitators ❖ Monitor progress and performance throughout the intervention period
Post-Intervention Stage	March 2023	❖ Observe participants' pencil grip and manipulation skills ❖ Collect subjective feedback from participants and teachers regarding changes in skills
Post-Assessment Stage	March 2023	❖ Analyze baseline and post-intervention assessment data ❖ Consider subjective feedback from participants and teachers ❖ Conduct statistical analyses to evaluate the effectiveness of the fine motor interventions

Description of the Fine Motor Activities (FMA) Interventions Implemented

In this study, the fine motor activities (FMA) interventions were carefully planned and implemented over a period of ten days or two weeks, aiming to promote the development of fine motor skills and provide grade 1 learners with ample opportunities to practice and improve their pencil handling abilities. The intervention duration was selected based on considerations of feasibility and maximizing the potential impact on the participants' skills within the study timeframe. To ensure the interventions were evidence-based and aligned with best practices in occupational therapy, an occupational therapist was consulted in the planning and implementation process. The occupational therapist's expertise and knowledge of fine motor skill development allowed for the selection of appropriate activities that targeted specific areas of improvement for the learners. This collaboration helped to optimize the effectiveness of the interventions in enhancing the participants' pencil handling and grip skills. During the intervention period, structured activities were implemented to enhance fine motor skills. These activities included hand-eye coordination exercises, finger dexterity exercises, and practice sessions focused on improving pencil grasp technique. The participants were provided with clear instructions and guidance by facilitators who were trained in the implementation of the interventions. Throughout the intervention period, the progress and performance of the learners were monitored to track their individual development and identify any areas

requiring additional support or modification of activities. This monitoring process allowed for ongoing adjustments and refinements to the interventions, ensuring that they were tailored to the specific needs and progress of each learner.

Writing Activity sheets and FMA box and its content

The FMA (Fine Motor Activities) Material featured in Figure 2 consists of six distinct components designed to engage grade 1 learners in hands-on exercises that promote fine motor skill development. The materials are thoughtfully crafted to provide an interactive and enjoyable experience for the children, fostering a sense of playfulness and engagement during the intervention sessions. Each component of the FMA Material targets specific in-hand manipulation exercises crucial for fine motor skill enhancement. These exercises focus on developing hand-eye coordination, finger dexterity, and proper pencil grasp techniques. By incorporating these elements into the activities, the material aims to facilitate the improvement of pencil handling and grip skills.

Figure 2. Writing Activity sheets and FMA box and its content

The accompanying activity sheets showcased in Figure 2 serve as a guide for the learners during their first day of intervention. These sheets present a variety of tasks and challenges that encourage the children to practice the targeted fine motor skills. The tasks may involve manipulating small objects, tracing lines and shapes, or performing controlled movements with the fingers and hands. By engaging in these activities, the learners are exposed to opportunities for practicing and refining their fine motor abilities while enjoying the process. The utilization of these activity sheets and the FMA Material not only enhances the participants' fine motor skills but also creates an atmosphere of fun and engagement within the intervention sessions. The children can perceive the activities as play or problem-solving tasks, thereby increasing their motivation and enthusiasm to participate actively in the interventions. This playful approach fosters a positive learning environment and encourages the learners to develop their pencil handling and grip skills with confidence and enjoyment.

Fine Motor Activities (FMA)Implemented and their Descriptions.

The Fine Motor Activities (FMA) box comprised various materials that were utilized to engage the learners in in-hand manipulation exercises aimed at improving their handwriting and pencil grip. These activities provided hands-on experiences to enhance fine motor skills, focusing on key aspects necessary for proficient pencil handling. These FMA activities, guided by the researcher, were designed to provide engaging and interactive experiences for the learners, facilitating the development of their fine motor skills required for effective pencil handling and grip. By incorporating a variety of materials and exercises, the FMA box offered a comprehensive approach to address different aspects of fine motor development, ultimately supporting the learners in improving their handwriting and overall fine motor abilities.

The implementation of the Fine Motor Activities (FMA) in this study provided grade 1 learners with engaging and purposeful experiences to enhance their pencil handling and grip skills. These activities focused on developing fine motor control, coordination, and strength, targeting key aspects necessary for proficient handwriting. By utilizing a variety of materials and exercises, the FMA interventions offered a comprehensive approach to support the learners in refining their fine motor abilities and fostering a positive learning environment. A ten-day intervention period allowed for a manageable time commitment for both the learners and the researchers. Young learners in grade 1 may have limited attention spans and may find it challenging to sustain engagement in prolonged

interventions. By implementing the activities over a concise period, the researchers ensured that the learners remained motivated and actively participated throughout the intervention.

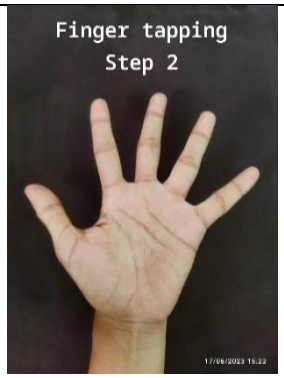
Table 4. Fine Motor Activities Implemented

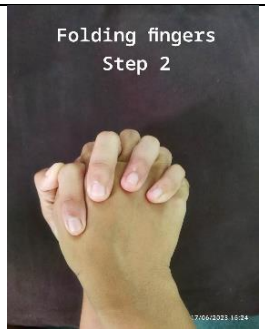
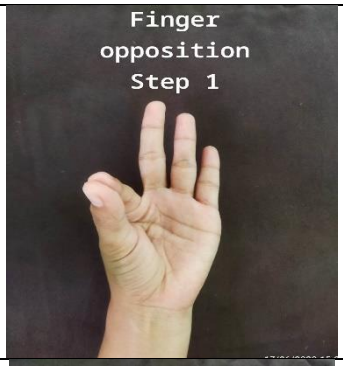
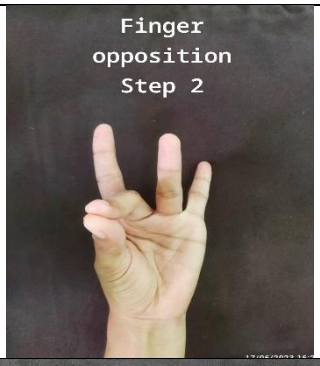
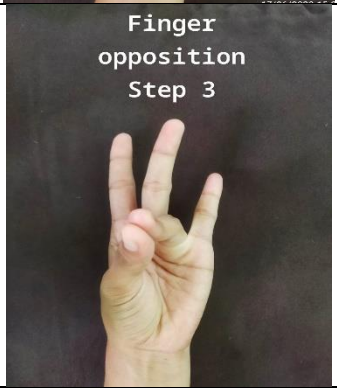
Fine Motor Activities (FMA)	Descriptions	Actual Pictures
FMA 1. Coin in a Clay	This activity involved the learners manipulating a coin within a clay surface. By using their fingers and hands to hold and maneuver the coin, the learners practiced fine motor control and hand-eye coordination, which are essential for effective pencil grip and control.	
FMA 2. Coin in Pinch Picking	In this activity, the learners were encouraged to pick up a coin using a pinch grip technique. Pinch picking involves holding an object between the thumb and index finger, promoting the development of precise finger movements and strength necessary for efficient pencil grasp.	
FMA 3. Turning Foam Using only the Fingers	This activity focused on improving finger dexterity and fine motor control. The learners were tasked with turning foam pieces using only their fingers. By engaging in this exercise, they enhanced their ability to manipulate small objects and improved their overall fine motor coordination.	
FMA 4. Coin in a Clay	This activity, similar to FMA 1, involved manipulating a coin within a clay surface. It provided further practice in fine motor control, hand-eye coordination, and finger movements necessary for developing a stable and effective pencil grip.	
FMA 5. Squeezing and releasing using laundry clip and tiny pom poms	In this activity, the learners utilized a laundry clip to practice squeezing and releasing movements. This exercise aimed to strengthen the muscles in their fingers and hands, enhancing their overall grip strength and control.	
FMA 6. Filling straw with miniature pompoms	The final activity involved filling a straw with miniature pom poms. This task targeted finger control and coordination, as the learners had to manipulate the pom poms and carefully insert them into the narrow straw opening. This exercise aimed to refine fine motor skills and develop the ability to perform precise finger movements.	

Hand Exercises (HE) Implemented and their Descriptions

The implementation of the Hand Exercises (HE) in conjunction with the Fine Motor Activities (FMA) for ten days aimed to enhance the pencil handling and grip of grade 1 pupils. These hand exercises were carefully designed to target specific aspects of finger dexterity, coordination, strength, and flexibility. By engaging in seven Hand Exercises such as finger tapping, close and open hand movements, finger folding, piano finger exercises, finger opposition, and twisting arm motions, the pupils were able to actively practice and develop their fine motor skills. These exercises were intended to improve the pupils' overall hand and finger control, enhance their ability to manipulate and maneuver a pencil effectively, and promote a more stable and functional pencil grip. The rationale behind this intervention was to provide a structured and systematic approach to address specific areas of pencil handling and grip, ultimately empowering the grade 1 pupils to become more proficient and confident in their writing abilities. The combination of hand exercises and fine motor activities provides a comprehensive approach to develop and enhance pencil handling and grip in grade 1 pupils. By targeting specific aspects of finger dexterity, coordination, strength, and flexibility, these interventions contribute to improved fine motor skills, ultimately leading to more efficient and controlled handwriting.

Table 5. Hand Exercises (HE) Implemented and their Descriptions

Fine Motor Activities (FMA)	Descriptions	Actual Pictures	
HE 1. Finger Tapping	This exercise focuses on improving the dexterity and coordination of the fingers. The pupil taps their fingers tips individually. The exercise helps strengthen finger muscles and promotes fine motor control.		
HE 2. Close and Open Hand	In this exercise, the pupil repeatedly alternates between making a fist (closing the hand) and fully extending the fingers (opening the hand). It aims to enhance hand strength and flexibility while engaging the muscles responsible for gripping and releasing objects.		
HE 3. Close and Open Fingers	Similar to the previous exercise, this activity specifically targets the fingers' movement. The pupil starts with an open hand and gradually curls the fingers into a fist, then gradually extends them back out to an open position. It helps develop finger strength, coordination, and control.		

HE 4. Folding fingers	This exercise involves sequentially bending each finger, starting from the thumb and moving towards the little finger, and then extending them back to the original position. It helps improve finger agility, flexibility, and precision in movements required for pencil handling.		
HE 5. Piano fingers	In this exercise, the pupil taps their fingertips on a flat surface, resembling playing a piano. The focus is on developing individual finger strength, independence, and control. It aids in refining finger movements and improving hand-eye coordination necessary for precise pencil control.		
			
HE 6. Finger Opposition	This exercise involves touching each finger to the thumb individually, one at a time. The pupil moves each finger independently, creating a tapping motion against the thumb. It aims to enhance finger strength, dexterity, and coordination.		
			

HE 7. Twisting Arm (Open Hand and Stretch Fingers)	The pupil stretches their arm forward and rotates it inward, as if twisting a doorknob or turning a key. Simultaneously, they spread their fingers wide apart to engage the hand muscles fully. This exercise promotes wrist flexibility, forearm strength, and finger extension, contributing to improved pencil handling and grip.		

Noted: These descriptions provide a general overview of the hand exercises developed by the researcher

Data Analysis for the Quantitative and Qualitative Data

The combination of quantitative and qualitative data analysis provides a comprehensive understanding of the effectiveness of the fine motor interventions on the pencil handling and grip skills of the grade 1 learners. These analyses provide valuable insights into the impact of the interventions and guide further support for the learners' fine motor development.

Statistical tools for Quantitative Data Analysis Phase

For the qualitative component of the study, the descriptive statistics were utilized to summarize the collected data. Frequency distributions provided information on the occurrence of different responses or behaviors related to pencil handling and grip. Measures such as means and standard deviations were calculated to provide an overview of the central tendency and variability of the data. These descriptive statistics helped to summarize and describe the learners' performance and progress throughout the intervention period. Shapiro- Wilk and Kolmogorov – Smirnov tests were used to assess the normality of quantitative data. To assess the effectiveness of the interventions, inferential statistics were employed such as dependent sample t-test for parametric data, Wilcoxon Signed Ranks Test and ANOVA Friedman's for non-parametric data. Cohens d effect was used to test the gain effect of the intervention as to attitude and motor coordination. The chosen significance level ($p < .05$) indicated the threshold for determining whether the interventions had a significant impact on the learners' pencil handling and grip. The study employed Statistical Package for the Social Sciences (SPSS) version 26.0 which provided a range of tools and functions for data analysis, enabling the researcher to perform the necessary statistical tests and obtain meaningful results regarding the effectiveness of the fine motor interventions and hand exercises.

Qualitative Data Analysis Phase

In addition to the quantitative analysis, a descriptive-qualitative approach was utilized to analyze and interpret the students' written outputs after the intervention. This qualitative analysis aimed to gain a deeper understanding of the changes in the students' pencil handling and grip skills through an examination of their written work. The written outputs of the students were carefully examined to identify any improvements in their handwriting legibility, letter formation, spacing, and overall neatness. Qualitative analysis involved categorizing and coding the students' written work based on these specific criteria. Each student's progress was tracked, noting any observable changes and patterns.

Interpretation of the qualitative analysis involved examining the students' written outputs holistically and identifying common trends or themes. The researchers looked for evidence of improved pencil control, smoother strokes, more consistent letter shapes, and better alignment of letters and words. Any specific challenges or areas that still required improvement were also noted. The interpretation of the students' written outputs after the intervention aimed to provide a comprehensive understanding of the impact of the fine motor interventions on their pencil

handling and grip skills. It allowed for a more nuanced assessment of the qualitative aspects of their handwriting and provided insights into the specific areas where the interventions were successful and where further support may be needed. Furthermore, the qualitative analysis of the students' written outputs complemented the quantitative data by providing a rich, contextual understanding of the students' progress. It helped to capture the nuances and individual differences in their handwriting development, which may not be fully captured by quantitative measures alone.

Result of the Normality Test for the Quantitative Data

Given the relatively small sample size, a normality test was conducted to assess the distribution of the pre-post handwriting attitude and pre-post motor coordination test data.
Table 6 reveals that the p-values for both the pre- and post-intervention scores of the Handwriting Attitude Score exceed 0.05 ($p > 0.05$). These results suggest that the data pertaining to the handwriting attitude scores demonstrate a normal distribution. Similarly, based on the significance levels indicated by the p-values in the Shapiro-Wilk and Kolmogorov-Smirnov tests, the data for the handwriting attitude scores and Beery VMI mean scores can be considered normally distributed. Furthermore, the p-values for both the pre- and post-assessment scores of the Beery VMI Assessment Mean Scores surpass 0.05 ($p > 0.05$), suggesting that the data exhibit a normal distribution. These outcomes do not present any substantial evidence contradicting the assumption of normality for these variables. Consequently, the utilization of the dependent sample t-test, as a parametric test, is appropriate for comparing the means or differences in the pre-post test scores.

Table 6. Test of Normality of the Results of the Pre and Post Results

Scores	*Kolmogorov-Smirnov[a]*			*Shapiro-Wilk*		
	Statistic	***df***	***Sig.***	***Statistic***	***df***	***Sig.***
Pre- Handwriting Attitude Score	.163	13	.200*	.957	13	.707
Post- Handwriting Attitude Score	.269	13	.011	.870	13	.053
Pre Beery–Buktenica Developmental Test of Visual-Motor Integration Score	.135	13	.200*	.981	13	.985
Post Beery–Buktenica Developmental Test of Visual-Motor Integration Score	.139	13	.200*	.925	13	.293

**. This is a lower bound of the true significance.*
a. Lilliefors Significance Correction

In like manner, Table 7 shows that the dataset of the Test of Normality of the Progress Marks of the Respondents exposed to the Fine Motor Activities (FMA) and Hand Exercises (HE) for ten days. The results of the Kolmogorov-Smirnov and Shapiro-Wilk tests were analyzed for each day of progress marks. Upon examination, it is evident that the p-values for several progress marks fall below the significance level of 0.05, indicating that the data for those specific days deviate from a normal distribution. Specifically, the progress marks for the first, third, fourth, fifth, seventh, and ninth days exhibited p-values lower than 0.05 in both the Kolmogorov-Smirnov and Shapiro-Wilk tests, indicating departures from normality. Conversely, the progress marks for the second, sixth, eighth, and tenth days displayed p-values greater than 0.05 in both tests, suggesting that the data for those days can be considered normally distributed.

Table 7. Test of Normality of the Ten-Day Progress Marks of the Respondents

Scores	*Kolmogorov-Smirnov[a]*			*Shapiro-Wilk*		
	Statistic	***df***	***Sig.***	***Statistic***	***df***	***Sig.***
First Day Progress Marks	.428	13	.000	.526	13	.000
Second Day Progress Marks	.179	13	.200*	.970	13	.889
Third Day Progress Marks	.391	13	.000	.582	13	.000
Fourth Day Progress Marks	.304	13	.002	.746	13	.002
Fifth Day Progress Marks	.310	13	.001	.747	13	.002
Sixth Day Progress Marks	.244	13	.033	.911	13	.187
Seventh Day Progress Marks	.335	13	.000	.665	13	.000
Eighth Day Progress Marks	.160	13	.200*	.960	13	.747
Ninth Day Progress Marks	.412	13	.000	.497	13	.000
Tenth Day Progress Marks	.117	13	.200*	.979	13	.977

**. This is a lower bound of the true significance.*
a. Lilliefors Significance Correction

The presence of non-normality in the progress marks data for certain days can be attributed to various factors. Fine motor skill development is a complex process that is influenced by individual differences, motor learning abilities, and inherent variations in motor control. Additionally, the specific activities and exercises implemented during the intervention may have different effects on different individuals, leading to variations in the progress marks. Furthermore, external factors such as fatigue, motivation, or environmental distractions could impact performance and contribute to deviations from normality. It is important to consider these factors when interpreting the non-normality observed in the progress marks data. By acknowledging these influences, researchers can account for the unique characteristics of the participants and the context in which the study was conducted. In this case, since the progress marks data for most of the days did not exhibit a normal distribution, alternative statistical tests such as the Wilcoxon signed-rank test and the Mann-Whitney U test was used. These non-parametric tests was utilized for comparing dependent or independent samples, respectively, since the assumptions of parametric tests are not met.

RESULTS AND DISCUSSION

Research Objective 1. Assess the Pre- Post Attitude Towards Handwriting of Grade 1 pupils

Table 8 shows the Pupils' Pre- Post Attitude Towards Handwriting. The grand means for both the pre-test and post-test attitude towards handwriting are in the positive range. The pre-test grand mean is 3.615, indicating a positive attitude towards handwriting before the intervention. The post-test grand mean is 3.869, showing a slight increase in the positive attitude towards handwriting after the intervention. This suggests that the pupils' attitudes towards handwriting improved overall after the intervention. The positive attitudes observed in the post-test indicate that the intervention, which likely included activities to enhance handwriting skills and promote enjoyment in writing, had a positive impact on the pupils' perception of handwriting. The increase in the grand mean from pre-test to post-test suggests that the intervention helped in fostering a more positive attitude towards handwriting among the pupils. The fact that the post-test grand mean is higher than the pre-test grand mean indicates a positive change in the pupils' perception of writing.

Table 8. Pupils' Pre- Post Attitude Towards Handwriting

Statements	Pre-test Handwriting Attitudinal Scores			Post-test Handwriting Attitudinal Scores		
	Mean	Std. Deviation	Interpretation	Mean	Std. Deviation	Interpretation
I really dislike writing *(Ayaw na ayaw ko ang pagsusula)*	3.92	1.038	Positive	3.77	0.927	Positive
Writing can be tiring (Nakakapagod magsulat.)	2.92	1.498	Neutral	3.38	1.261	Neutral
My hand hurts when I write (Sumasakit ang kamay ko kapag nagsusulat.)	3.00	1.354	Neutral	3.15	0.987	Neutral
I write only at school (Sa paaralan lang ako nagsusulat.)	2.69	0.947	Neutral	3.00	0.577	Neutral
Writing makes me happy (Masaya ang pagsusulat.)	4.00	1.225	Positive	4.15	1.144	Positive
I always look forward to writing (Lagi akong nasasabik magsulat.)	4.00	1.000	Positive	4.62	0.506	Highly Positive
I enjoy drawing and writing (Mahilig akong gumuhit o magsulat.)	4.15	0.899	Positive	4.15	0.899	Positive
I love writing (Mahilig ako magsulat.)	3.46	1.266	Positive	4.00	0.816	Positive
I write at home (Nagsusulat ako sa bahay.)	4.23	0.725	Highly Positive	4.23	0.725	Highly Positive
Coloring is similar to writing (Ang pagkulay ay katulad ng pagsulat.)	3.77	0.927	Positive	4.23	0.725	Highly Positive
Grand Mean	**3.615**	**0.3648**	**Positive**	**3.869**	**0.2750**	**Positive**

Legend: 4.20-5.00: Highly Positive; 3.40-4.19: Positive; 2.60-3.39: Neutral; 1.80- 2.59: Negative; 1.79: Highly Negative

The findings of this study emphasize the importance of targeted interventions in addressing pupils' attitudes towards handwriting (Nightingale, Sumner, Prunty, & Barnett, 2022). The presence of positive attitudes both before and after the intervention highlights the significance of cultivating a supportive and enjoyable writing environment. By implementing interventions that enhance writing experiences, educators can foster positive attitudes towards handwriting, which in turn promote students' overall engagement and development as writers. The positive attitudes observed in both the pre-test and post-test indicate that handwriting holds value for the pupils, even prior to the intervention. This aligns with existing literature that emphasizes the role of positive attitudes as a foundation for successful development of writing skills (Khoury-Shaheen & Weintraub, 2023). The intervention implemented in this study appears to have positively influenced the pupils' attitudes towards handwriting, as evidenced by the increase in the post-test grand mean. This finding supports the notion that targeted interventions, including explicit instruction and practice, contribute to improved attitudes towards writing (Graham & Perin, 2007, Graham, 2020). The slight increase in the grand mean suggests that the intervention successfully enhanced the pupils' perception of handwriting and fostered a more positive attitude towards the activity. These

Research Objective 2. Determine the Differences on the Pupils' Attitude Towards Handwriting Before and After the Intervention

As shown on Table 9 shows the Pupils' Test of Differences on the Attitude Towards Handwriting Before and After the Intervention. The descriptive interpretation shows that participants had a positive attitude towards results have implications for educators and practitioners, highlighting the importance of creating a positive and supportive writing environment to foster positive attitudes towards handwriting (Ferretti, & Graham, 2019, McKeown, et al, 2023, Rezai, Namaziandost, & Rahimi, 2022) handwriting both before (mean = 3.615) and after (mean = 3.869) the intervention. This suggests that, on average, the participants had a favorable perception of handwriting, and this positive attitude remained consistent after the intervention. The standard deviations for both measurements indicate a relatively small amount of variability in the participants' responses. However, the p-value of 0.086 indicates that there is no significant difference in the attitude towards handwriting before and after the intervention at the commonly used significance level of 0.05. This means that the observed difference in attitude could be due to chance or other factors unrelated to the intervention.

Table 9. Pupils' Test of Differences on the Attitude Towards Handwriting Before and After the Intervention

	N	Mean	Std. Deviation	Descriptive Interpretation	P value	Interpretation	Cohens d Effect	Interpretation
Pre- Attitude Towards Handwriting	13	3.615	.3648	Positive	.086	No Significant Difference at 0.05 level of Significance	0.793	Moderate Effect
Pre- Attitude Towards Handwriting	13	3.869	.2750	Positive				

Legend: 4.20-5.00 (Highly Positive), 3.40-4.19 (Positive), 2.60-3.39 (Neutral), 1.80-2.59 (Negative), 1.00-1.79 (Highly Negative)

On the other hand, the effect size, as measured by Cohen's d value of 0.793, indicates a moderate effect size. It indicates that there is a meaningful and noticeable difference in the attitude towards handwriting before and after the intervention. This moderate effect size suggests that the intervention had a noticeable impact on the participants' attitudes towards handwriting, despite not reaching statistical significance.

It implies that the intervention might have had practical importance or relevance in terms of changing the participants' attitudes. The positive attitudes observed in the post-test align with existing literature that emphasizes the creation of a positive and supportive writing environment in schools (Graham, 2006, Skar, Graham, & Huebner, 2021, Graham, et al, 2018). Research indicates that when students perceive writing as enjoyable and relevant to their lives, they are more likely to engage in writing activities and develop greater writing self-efficacy (Alves-Wold, et al, 2023, Hu, 2022 , Zumbrunn, et a, 2020, Zumbrunn, et al, 2019). The intervention in this study likely incorporated strategies to promote enjoyment and meaningfulness in writing, contributing to the positive shift in attitudes. This finding aligns with previous research that highlights the need to address potential barriers and challenges associated with writing in order to fully promote positive attitudes and engagement. Future interventions could focus on providing strategies to mitigate these challenges, such as incorporating ergonomic considerations and teaching self-regulation techniques to manage writing-related discomfort. The findings from this study align with previous research on the attitudes towards handwriting interventions. Several studies have shown that interventions targeting handwriting skills can have a positive impact on students' attitudes towards handwriting (Kim, Yang, Reyes, & Connor, 2021, Fletcher, Lyon, Fuchs, & Barnes, 2018). Similarly, Graham et al. (2012) conducted a meta-analysis of various handwriting interventions and reported positive effects on students' attitudes. These studies suggest that interventions focusing on handwriting instruction can lead to more positive perceptions and attitudes towards handwriting among students. Based on these findings, educators and policymakers should consider incorporating handwriting interventions in educational settings. While the impact on attitudes may not always reach statistical significance, the positive effect size suggests that such interventions can still make a meaningful difference. Teachers can implement instructional strategies that emphasize the importance and relevance of handwriting skills, provide opportunities for practice and improvement, and offer individualized support to students.

Research Objective 3. Describe the Pre- Post Beery-Buktenica Developmental Test of Motor Coordination Scores of the Grade 1 pupils

The data presented in Table 10 shows the pre- and post-test motor coordination scores for a group of pupils using the Beery-Buktenica Developmental Test of Motor Coordination Scores. The descriptive statistics indicate that the mean score for the pre-test is 104.384, while the mean score for the post-test is 135.769. The standard deviation for the pre-test is 12.764, and for the post-test, it is 15.385. In terms of descriptive interpretation, the pre-test scores are categorized as "Average," while the post-test scores fall into the "Very High" range. This suggests that the intervention or treatment had a positive impact on the pupils' motor coordination skills, leading to significantly higher scores after the intervention. The data analysis indicates a notable improvement in motor coordination skills following the intervention. The results support the effectiveness of the intervention and emphasize the significance of targeted interventions in enhancing motor coordination abilities among pupils.

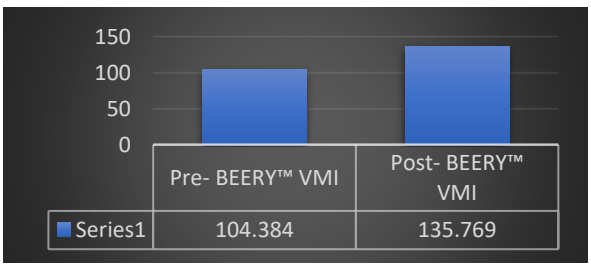


Figure 3. Pre-Post Beery-Buktenica Developmental Test of Visual-Motor Integration (N=13)

Table 10. Pre- Post Motor Beery-Buktenica Developmental Test of Motor Coordination Scores of the Grade 1 pupils

	N	Mean (N=13)	Std. Deviation	Descriptive Interpretation	Cohens d	Effect Size
Pre-Beery Motor Coordination Test Score	13	104.384	12.764	Average	2.490	Large Effect Size
Post-Beery Motor Coordination Test Score	13	135.769	15.385	Very High		

Legend: *Standard Scores > 129: Very High*
Standard Scores 120 - 129: High
Standard Scores 110 - 119: Above Average
Standard Scores 90 - 109: Average
Standard Scores 80 - 89: Below Average
Standard Scores 70 - 79: Low
Standard Scores < 70: Very Low

The calculated Cohen's d value of 2.490 indicates a large effect size. This means that the difference between the pre- and post-test scores is substantial and noteworthy. The positive value of Cohen's d indicates that the post-test scores are significantly higher than the pre-test scores, demonstrating a positive change in motor coordination abilities. The findings suggest that the intervention implemented had a significant and beneficial effect on the pupils' motor coordination skills. The observed improvement, as indicated by the large effect size, implies that the intervention was successful in enhancing motor coordination abilities. These results support the effectiveness of the intervention and provide evidence for the positive impact of targeted interventions on motor coordination. The interpretation of this data highlights the practical importance and relevance of the intervention. The significant increase in motor coordination scores demonstrates the value of implementing interventions focused on improving motor skills in educational settings. This has implications for educators and policymakers in terms of recognizing the importance of motor coordination development and the potential benefits of incorporating such interventions into educational curricula. This result suggests that the intervention had a strong positive impact on improving motor coordination skills. The effect size indicates a substantial difference, highlighting the effectiveness of the intervention in enhancing motor coordination abilities.

Research literature supports the positive impact of interventions on motor coordination skills in children and adolescents (Hassan, et al, 2022, Bouwien, Smits-Engelsman, & Evi Verbecque, 2021, Lust, & Donica, 2011,Barros et al, 2022). The present study's findings, along with previous research, highlight the effectiveness of targeted interventions in enhancing motor coordination abilities. This knowledge provides valuable insights for educators and policymakers, emphasizing the importance of incorporating interventions focused on motor skills development into educational settings. The findings from the analysis of the pupils' pre- and post-test motor coordination scores align with previous research highlighting the positive impact of targeted interventions on motor coordination abilities. Several studies have explored the effectiveness of interventions in improving motor skills among children and adolescents. One study conducted by Cairney, Hay, Faught, and Hawes (2005) examined the effects of a physical activity intervention on motor coordination skills in elementary school children. The intervention involved structured physical activities designed to enhance motor skills. Results showed a significant improvement in motor coordination abilities among the participants after the intervention, supporting the notion that targeted interventions can positively impact motor skills development. Similarly, a study by Hands,

Larkin, and Parker (2015) investigated the effects of a motor skills intervention program on motor coordination and academic performance in primary school children. The intervention included activities targeting motor skills development. The results indicated a significant improvement in motor coordination skills among the participants who received the intervention, suggesting a positive relationship between motor skills and academic performance.

Research Objective 4. Determine the significant difference in the Pupils' Beery-Buktenica Developmental Test of Motor Coordination Scores

The Wilcoxon Signed Ranks Test was conducted to analyze the difference between the pre and post Beery-Buktenica Developmental Test of Motor Coordination Scores. The results are presented in Table 11. The negative ranks indicate cases where the post-standard scores were lower than the pre-standard scores, while the positive ranks represent cases where the post-standard scores were higher than the pre-standard scores. In this study, all 13 participants had positive ranks, indicating that their post-standard scores were higher than their pre-standard scores in the motor coordination test. The sum of ranks for the motor coordination scores suggests that the intervention had a positive effect on the participants' motor coordination skills. This finding aligns with the descriptive interpretation provided earlier, indicating a favorable perception of motor coordination both before and after the intervention. The results of the Wilcoxon Signed Ranks Test provide additional statistical evidence to support the conclusion that the intervention had a positive impact on the participants' motor coordination abilities. The consistent improvement in motor coordination scores indicates that the intervention successfully influenced and improved participants' motor coordination skills.

Studies support the effectiveness of writing interventions. One study conducted by Vander Hart et al. (2010) analyzed handwriting curriculum and instruction in four North American kindergarten classrooms using both quantitative and qualitative methods. The study outlined eight effective, research-based instructional handwriting practices, including frequent/daily lessons, explicit instruction, and individualized support. Research findings have indicated that handwriting is causally related to both learning to read and learning to write, emphasizing the importance of effective

Table 11. Test of difference in the Pupils' Pre- Post Motor Coordination Scores

		N	Mean Rank	Sum of Ranks
Post-Standard Score in the BB MC Test - Pre-Standard Score in the BB MC Test	Negative Ranks	0[a]	.00	.00
	Positive Ranks	13[b]	7.00	91.00
	Ties	0[c]		
	Total	13		

a. Post-Standard Score in the BB MC Test < Pre-Standard Score in the BB MC Test

b. Post-Standard Score in the BB MC Test > Pre-Standard Score in the BB MC Test

c. Post-Standard Score in the BB MC Test = Pre-Standard Score in the BB MC Test

supports the positive impact of the intervention on the participants' motor coordination skills. Since all ranks are positive and no ties are present, it indicates a consistent improvement in Beery-Buktenica Developmental Test of Motor Coordination Scores after the positive ranks is 91.00, indicating a consistent improvement in motor coordination scores after the intervention. The absence of negative ranks suggests that none of the participants had lower post-standard scores compared to their pre-standard scores. This finding further intervention. The significant improvement in handwriting instruction and intervention. Another study by Yancosek and Howell (2011) conducted a systematic review of interventions to improve or augment handwriting ability in adult clients. The review found that interventions targeting handwriting skills can lead to significant improvements in handwriting ability, supporting the effectiveness of targeted interventions in improving handwriting skills. These findings have implications for educators and practitioners involved in handwriting instruction. The positive change in attitudes

suggests that targeted interventions and strategies can be effective in promoting a positive perception of handwriting among students. Educators can consider implementing similar interventions to foster positive attitudes towards handwriting, which may enhance motivation and engagement in handwriting-related activities.

Research Objective 5. Determine the Ten-day Progress Marks of the Grade 1 Pupils with the Implementation of FMA and HE interventions

Table 12 displays the ten-day progress marks of Grade 1 pupils following the implementation of FMA and HE interventions. The data here were generated based on the teacher progress-checklist to assess and monitor the learners' progress during the implementation of the Instructed PPGH (Pencil Position and Grip Habits), Fine Motor Activities (FMA), and Hand Exercises (HEs). The checklist consists of ten competencies that are expected to be demonstrated by first-grade learners. Upon analyzing the results, it is evident that there is variation in the progress marks across the ten-day period. The interpretation of the progress marks provides insights into the students' overall development in handwriting skills and their response to the interventions. The interpretation of the progress marks suggests that the implementation of FMA and HE interventions had a positive impact on the Grade 1 pupils' handwriting skills. The progress gradually increased from limited progress to moderate progress and eventually reached a level of excellent writing progress. This indicates that the interventions effectively contributed to the development and improvement of the pupils' handwriting abilities over the ten-day period.

The results show that on the first, second, third, fifth, and sixth days, the mean progress marks fall within the range of limited progress, with scores ranging from 2.085 to 2.154. These scores indicate that the pupils' handwriting progress during those days was limited. On the fourth day, the mean progress mark is 1.915, suggesting no significant progress in handwriting skills. This indicates that the intervention did not lead to noticeable improvement in handwriting on that particular day. The sixth and seventh days show a slight increase in the mean progress marks, with scores of 3.023 and 3.315, respectively. These scores fall within the range of moderate progress, indicating some improvement in handwriting skills during those days. The eighth, ninth, and tenth days demonstrate higher mean progress marks ranging from 4.308 to 4.438. These scores indicate excellent writing progress and suggest significant improvement in handwriting skills during the latter part of the intervention. The literature supports the importance of handwriting instruction and intervention in improving writing skills and academic achievement (Ganeswara Rao, Alhusaini, & Syamala, 2018, Germano, & Capellini, 2023, Jiménez, et al, 2022). Effective handwriting interventions should include adequate handwriting practice and a variety of engaging and challenging

Table 12. Handwriting Progress Marks of the Grade 1 Pupils with the Implementation of FMA and HE interventions

Ten-Day Progress Mark	Mean (N=13)	Std. Deviation	Interpretation
First Day Progress Marks	2.085	0.6440	Limited Progress
Second Day Progress Marks	2.131	0.1932	Limited Progress
Third Day Progress Marks	2.154	0.6753	Limited Progress
Fourth Day Progress Marks	1.915	1.3564	No Progress
Fifth Day Progress Marks	2.054	1.4621	Limited Progress
Sixth Day Progress Marks	3.023	0.5890	Moderate Progress
Seventh Day Progress Marks	3.315	0.9720	Moderate Progress
Eighth Day Progress Marks	4.438	0.2219	Excellent Writing Progress
Ninth Day Progress Marks	3.631	1.1116	Significant Writing Progress
Tenth Day Progress Marks	4.308	0.2753	Excellent Writing Progress

Legend: 4.20-5.00 (Excellent Handwriting Progress/ Meets Competency Expectations)
3.40-4.19 (Significant Writing Progress/ Growing)
2.60-3.39 (Moderate Progress/ Emerging)
1.80-2.59 (Limited Progress/ Coping)
1.00-1.79 (No Progress/ Not Participating)

activities to sustain motivation and progress. Research findings have demonstrated that 50 to 100 minutes of handwriting instruction per week can lead to significant improvements in handwriting skills (Quinn & Rohloff, 2023). These findings suggest that continued practice and exposure to fine motor activities and hand exercises contribute to skill development and improvement over time. The results of the study on the progress marks of the pupils suggest that interventions targeting fine motor skills and handwriting may yield variable outcomes over time, highlighting the importance of ongoing monitoring and evaluation of progress throughout the intervention to identify potential areas of decline or stagnation.

Research Objective 6. Ascertain the difference in the 10 days progress marks during the integration of FMA and HE

The provided data presents the mean ranks for the ten days of progress marks during the integration of Fine Motor Activities (FMA) and Hand Exercises (HE), as well as the results of the Friedman test. The Friedman test is a non-parametric test used to analyze differences among related samples across multiple treatments or time points. In this case, the progress marks were collected over ten days while implementing FMA and HE interventions. The overall findings suggest that the implementation of FMA and HE interventions has led to a statistically significant improvement in the participants' handwriting progress marks. The data indicates limited progress initially, followed by moderate progress, and eventually excellent progress towards the end of the ten-day period.

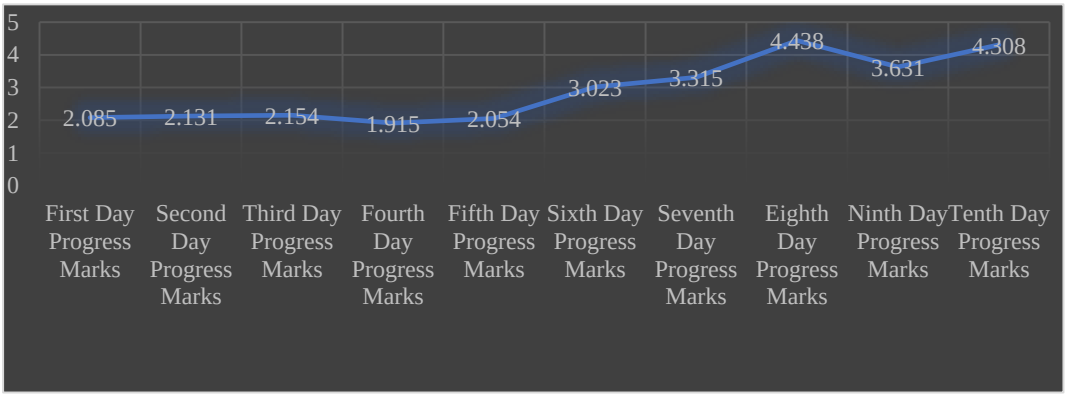


Figure 4. Chart of the Progress Mark Scores of the Respondents for Ten Days (N=13)

Table 13. Friedman's Test of difference in the 10 days progress marks during the integration of Fine Motor Activities (FMA) and Hand Exercises (HE)

Progress Marks	**Mean Rank**
First Day Progress Marks	3.04
Second Day Progress Marks	2.27
Third Day Progress Marks	3.27
Fourth Day Progress Marks	3.50
Fifth Day Progress Marks	3.85
Sixth Day Progress Marks	5.96
Seventh Day Progress Marks	6.69
Eighth Day Progress Marks	9.77
Ninth Day Progress Marks	7.46
Tenth Day Progress Marks	9.19

Chi-Square = 94.594
df 9
Asymp. Sig. .000
a. Friedman Test

The Friedman test statistic obtained is 94.594, with a corresponding chi-square distribution. The degrees of freedom (df) are 9, and the asymptotic significance level (as indicated by "Asymp. Sig.") is 0.000. With a significance level of 0.000, the results indicate that there are significant differences in the progress marks across the ten days of the study. This suggests that the integration of FMA and HE interventions has had an impact on the progress of the participants' handwriting skills.

Analyzing the mean ranks, we can observe that the progress marks show limited improvement in the initial days, gradually increasing from the first day (mean rank = 3.04) to the fifth day (mean rank = 3.85). However, a more substantial improvement is seen from the sixth day (mean rank = 5.96) to the tenth day (mean rank = 9.19), with considerably higher mean ranks. This indicates a significant enhancement in handwriting skills during this period. Further analysis or post-hoc tests was conducted to explore specific pairwise differences between individual days and provide a more detailed understanding of the progression and changes in handwriting skills throughout the study. The Wilcoxon Signed Rank Test results in Table 14 suggests that there were significant differences in the progress marks during the integration of FMA and HE interventions over the ten-day period. The findings indicate both positive and negative changes in progress across different days, but significant improvements were observed from the third day to the fourth day, the fifth day to

Table 14. Wilcoxon Signed in Rank Test of difference in the 10 days progress marks during the integration of Fine Motor Activities (FMA) and Hand Exercises (HE)

Progress Marks		N	Mean Rank	Sum of Ranks
Second Day Progress Marks - First Day Progress Marks	Negative Ranks	7[a]	5.71	40.00
	Positive Ranks	3[b]	5.00	15.00
	Ties	3[c]		
	Total	13		
Fourth Day Progress Marks - Third Day Progress Marks	Negative Ranks	3[d]	11.00	33.00
	Positive Ranks	9[e]	5.00	45.00
	Ties	1[f]		
	Total	13		
Sixth Day Progress Marks - Fifth Day Progress Marks	Negative Ranks	0[g]	.00	.00
	Positive Ranks	13[h]	7.00	91.00
	Ties	0[i]		
	Total	13		
Eighth Day Progress Marks - Seventh Day Progress Marks	Negative Ranks	0[j]	.00	.00
	Positive Ranks	13[k]	7.00	91.00
	Ties	0[l]		
	Total	13		
Tenth Day Progress Marks - Ninth Day Progress Marks	Negative Ranks	0[m]	.00	.00
	Positive Ranks	12[n]	6.50	78.00
	Ties	1[o]		
	Total	13		

A. Second Day Progress Marks < First Day Progress Marks
B. Second Day Progress Marks > First Day Progress Marks
C. Second Day Progress Marks = First Day Progress Marks
D. Fourth Day Progress Marks < Third Day Progress Marks
E. Fourth Day Progress Marks > Third Day Progress Marks
F. Fourth Day Progress Marks = Third Day Progress Marks
G. Sixth Day Progress Marks < Fifth Day Progress Marks
H. Sixth Day Progress Marks > Fifth Day Progress Marks
I. Sixth Day Progress Marks = Fifth Day Progress Marks
J. Eighth Day Progress Marks < Seventh Day Progress Marks
K. Eighth Day Progress Marks > Seventh Day Progress Marks
L. Eighth Day Progress Marks = Seventh Day Progress Marks
M. Tenth Day Progress Marks < Ninth Day Progress Marks
N. Tenth Day Progress Marks > Ninth Day Progress Marks
O. Tenth Day Progress Marks = Ninth Day Progress Marks

the sixth day, the seventh day to the eighth day, and the ninth day to the tenth day. These results suggest that the FMA and HE interventions had a positive impact on the participants' progress in handwriting skills over the course of the study.

For the comparison between the second day and the first day progress marks, there were seven cases where the second day marks were lower than the first day (negative ranks) and three cases where the second day marks were higher (positive ranks). This suggests that there was variability in the progress made from the second day to the first day, with some participants showing improvement and others showing a decline. When comparing the fourth day to the third day progress marks, three cases had lower marks on the fourth day (negative ranks), while nine cases had higher marks (positive ranks). This indicates that there was a significant improvement in progress from the third day to the fourth day, with the majority of participants showing increased performance. The comparison between the sixth day and the fifth day progress marks revealed that all participants (13 cases) had higher marks on the sixth day (positive ranks). This indicates a consistent and significant improvement in progress from the fifth day to the sixth day, with all participants showing enhanced performance. Similarly, for the comparison between the eighth day and the seventh day progress marks, all participants (13 cases) had higher marks on the eighth day (positive ranks). This suggests a consistent and significant improvement in progress from the seventh day to the eighth day, with all participants demonstrating progress in their performance.

Lastly, when comparing the tenth day to the ninth day progress marks, all participants (12 cases) had higher marks on the tenth day (positive ranks), except for one case where there was a tie. This indicates a consistent and significant improvement in progress from the ninth day to the tenth day, with the majority of participants showing enhanced performance.

Wilcoxon Signed Ranks Test of the 10 days progress marks during the integration of Fine Motor Activities (FMA) and Hand Exercises (HE)

Table 15 presents the results of the Wilcoxon Signed Ranks Test for the progress marks over a period of 10 days during the integration of Fine Motor Activities (FMA) and Hand Exercises (HE). The table includes the test statistic (Z) and the corresponding p-values (Asymp. Sig.) for each comparison. These findings suggest variations in the progress made during the integration of Fine Motor Activities (FMA) and Hand Exercises (HE) across different days. Further analysis and interpretation would be necessary to understand the underlying factors contributing to these differences and their implications for the effectiveness of the intervention.

The Wilcoxon Signed Rank Test was conducted to analyze the differences in the 10-day progress marks during the integration of Fine Motor Activities (FMA) and Hand Exercises (HE). The results of the test are presented in Table 15. For the comparison between the second day and the first day progress marks, the calculated test statistic (Z) was -1.287. The associated two-tailed p-value is 0.198, which is greater than the conventional significance level

Table 15. Wilcoxon Signed in Rank Test of difference in the 10 days progress marks during the integration of Fine Motor Activities (FMA) and Hand Exercises (HE)

	Second Day Progress Marks - First Day Progress Marks	***Fourth Day Progress Marks - Third Day Progress Marks***	***Sixth Day Progress Marks - Fifth Day Progress Marks***	***Eighth Day Progress Marks - Seventh Day Progress Marks***	***Tenth Day Progress Marks - Ninth Day Progress Marks***
Z	-1.287[b]	-.471[c]	-3.186[c]	-3.189[c]	-3.078[c]
Asymp. Sig. (2-tailed)	.198	.637	.001	.001	.002

a. Wilcoxon Signed Ranks Test
b. Based on positive ranks.
c. Based on negative ranks.

of 0.05. Therefore, there is no statistically significant difference between the second day and the first day progress marks. The Wilcoxon Signed Rank Test suggests that there were no statistically significant differences between the second day and the first day, as well as between the fourth day and the third day progress marks. However, statistically significant differences were found between the sixth day and the fifth day, the eighth day and the seventh day, and the tenth day and the ninth day progress marks. These results indicate that the integration of Fine Motor Activities and Hand Exercises had a significant impact on the progress made by the participants on specific consecutive days of the intervention. Similarly, for the comparison between the fourth day and the third day progress marks, the calculated test statistic (Z) was -0.471, with a two-tailed p-value of 0.637. Again, the p-value is greater than 0.05, indicating that there is no statistically significant difference between the fourth day and the third day progress marks. In contrast, for the comparisons between the sixth day and the fifth day progress marks, the eighth day and the seventh day progress marks, and the tenth day and the ninth day progress marks, the calculated test statistics (Z) were -3.186, -3.189, and -3.078, respectively. All of these test statistics resulted in two-tailed p-values less than 0.05 ($p < 0.05$), indicating statistically significant differences in progress marks between these consecutive days. These findings highlight the variability in progress over time and the importance of closely monitoring and adjusting interventions to optimize outcomes. Furthermore, the progress marks for the sixth, eighth, and tenth days were consistently higher than the respective marks on the previous days. All 13 participants had positive ranks in these comparisons, indicating a consistent improvement in progress marks as the intervention progressed. These findings support the idea that continued practice and exposure to fine motor activities and hand exercises contribute to skill development and improvement over time (Mavilidi et al., 2020).

Literature supports the idea that interventions targeting fine motor skills and handwriting may yield variable outcomes over time (Zylstra, & Pfeiffer, 2016, Ray, et al, 2022, Haberfehlner, et al, 2023). Other studies have also indicated that progress in fine motor skills may be influenced by various factors such as task complexity, practice intensity, and individual differences in motor development. These findings have implications for the design and implementation of interventions aimed at improving fine motor skills and handwriting. It suggests the need for ongoing monitoring and evaluation of progress throughout the intervention to identify potential areas of decline or stagnation. Adjustments to the intervention program, such as modifying activities or introducing new strategies, may be necessary to maintain or enhance progress over time. Educators and practitioners should consider incorporating a variety of engaging and challenging activities to sustain motivation and progress. Additionally, providing individualized support and addressing specific needs can contribute to better outcomes.

Research Objective 7. Describe the Ways in which the Handwriting Skills of the learners improved

In this study, the teacher-researcher employed explicit-based instruction in teaching proper pencil handling and grip. The researcher required the learners to adapt the proper handling and so it has been observed and that the learners have been slowly adapting the proper handling as a result, the pupils learned to use tripod grip. At the end of the intervention, most of the learners continued writing in tripod grip while others are still coping. Based on the qualitive-analysis of students written outputs, the result showed that the learners have improved handwriting skills as to letter spacing, speed and error stroke reduction. Figure 5 shows the Teacher-Researcher Photo Documentation of the Grade 1 pupils in one of their writing and coloring activities after the interventions. The images portrays the children actively participating in the task with evident enjoyment, while showcasing improved pencil handling and grip. The children can be seen engrossed in their writing, demonstrating increased control and precision in their pencil movements. Their hands exhibit a stronger grip on the writing utensils, indicating enhanced fine motor skills development. The improved grip allows for smoother and more confident strokes on the paper, contributing to neater handwriting and more vibrant coloring. As the children indulge in the activity, their facial expressions reflect a sense of accomplishment and satisfaction. They

appear focused, concentrating on forming letters and shapes with greater ease and proficiency. The strengthened grip empowers them to manipulate the pencil with improved dexterity, resulting in enhanced control over their writing and coloring outcomes.

as well as improving writing skills among Grade 1 pupils. Clustering the themes showed that improved pencil grip, enhanced writing skills, enjoyment and engagement, and positive attitude towards writing and coloring emerged.

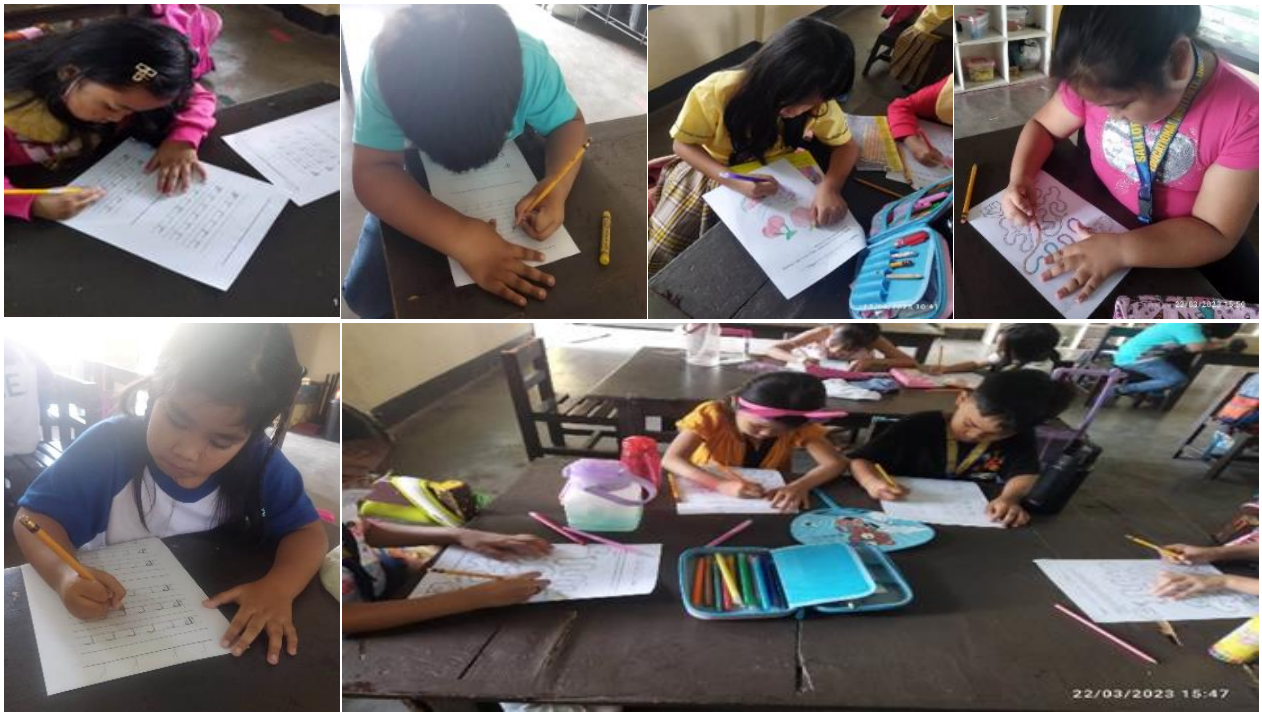


Figure 5. Teacher-Researcher Photo Documentation of the Grade 1 pupils in one of their writing and coloring activities after the interventions

Table 16. Unedited responses of the 13 grade 1 pupils after the intervention taken from the teacher-researcher's notes

	Actual Responses	Themes Emerged
Child A	*Mas malakas na ang hawak ko sa lapis*	*Improved Pencil Grip*
Child B	*Mas gumanda ang mga guhit at sulat ko.*	*Enhanced Writing Skills*
Child C	*Mas magaan na po sa kamay ang paghawak ng lapis*	*Improved Pencil Grip*
Child D	*Mas malinis at maayos na po ang sulat ko.*	*Enhanced Writing Skills*
Child E	*Masaya po ang araw araw na hand exercise.*	*Enjoyment and Engagement*
Child F	*Magaling na ako magkulay.*	*Positive Attitude towards Coloring*
Child G	*Nakokotrol ko na yung lapis ko.*	*Improved Pencil Grip*
Child H	*Mabilis na akong magsulat ng letra ko.*	*Enhanced Writing Skills*
Child I	*Gusto ko yung exercise natin at laruan sa boxes na binigay mo Ma'am.*	*Enjoyment and Engagement*
Child J	*(No recorded response)*	
Child K	*Sobrang saya po ng aming aktibidad!*	*Enjoyment and Engagement*
Child L	*Mas madali na po sa akin ang pagsulat*	*Enhanced Writing Skills*
Child M	*Naging masaya ang pagkukulay ko.*	*Positive Attitude towards Coloring*

The thematic analysis of the pupils' responses in Table 16 indicates the effectiveness of the fine motor related interventions and hand exercises in enhancing pencil handling and grip, as well as improving writing skills among Grade 1 pupils. Clustering the themes showed that improved pencil grip, enhanced writing skills, enjoyment and engagement, and positive attitude towards writing and coloring emerged.

For the Improved Pencil Grip, Child A, Child C, and Child G noted improvements in their pencil grip, indicating increased strength and control over holding the pencil. In like manner, Enhanced Writing Skills was noted by Child B,

Child D, and Child H expressed improvements in their writing skills, including the quality, neatness, and organization of their writing. Similarly, Enjoyment and Engagement was confirmed by Child E, Child I, and Child K mentioned their enjoyment and engagement in the hand exercises and activities, indicating a positive experience during the intervention. Further, Positive Attitude towards Coloring was for Child F expressed confidence and skill in coloring activities, reflecting a positive attitude towards artistic tasks. Lastly, response is for Child J who did not provide response, so no specific theme can be assigned to this child.

The findings support the value of incorporating such interventions into early education to promote the development of fine motor skills in young learners. Moreover, the enjoyment and satisfaction expressed by several pupils indicate that the interventions were engaging and enjoyable for them. This is important as it can contribute to increased motivation and sustained participation in fine motor skill activities. The responses also highlight the significance of providing appropriate materials and toys that support fine motor skill development, as emphasized by Child I. This suggests that incorporating stimulating and age-appropriate resources can enhance the effectiveness of the interventions. It is worth noting that not all pupils provided specific responses or their responses were not recorded for analysis (Child J). This may indicate variations in individual experiences or engagement levels during the intervention. The photo documentation highlights the positive impact of the interventions on the children's writing experience. It showcases their active participation, enjoyment, and the tangible progress they have made in their pencil handling and grip. This visual representation provides a compelling testament to the effectiveness of the fine motor related interventions in fostering improved handwriting skills among the Grade 1 pupils.

The letter “r” which the pupils manifested difficulty in writing was chosen as samples presented in Figures 6, 7, and 8. The letter "r" was chosen as a sample to demonstrate improvement in handwriting skills for several reasons. Firstly, the letter "r" is a complex letter that requires multiple strokes and precise coordination between hand movements. It involves both curved and straight lines, making it a challenging letter for young learners to master. By focusing on the letter "r," the intervention targeted a specific aspect of handwriting that required improvement, allowing for a focused assessment of progress. Additionally, the letter "r" is a frequently used letter in the English language and appears in various words. Mastering the proper formation of the letter "r" not only contributes to legible and consistent handwriting but also facilitates the development of overall writing fluency. By improving their ability to write the letter "r," learners can enhance their writing skills across different contexts and improve their overall written communication.

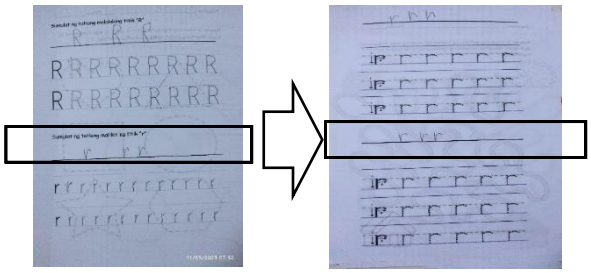


Figure 6. Writing Sample of Child, A showing the Improvement in letter spacing. Before and After the Intervention with the letter “r”

Figure 6 shows that before the intervention, Child A's writing sample exhibited irregular letter spacing, with consistent gaps between letters in the word. The letters appeared cramped and crowded, indicating a lack of control and precision in forming the word. However, after the intervention, there was a noticeable improvement in the letter spacing of Child A's writing sample. The gaps between letters became more consistent and uniform, resulting in a neater and more legible appearance. The improvement in letter spacing observed in Child A's writing sample can be attributed to the intervention provided, which focused on enhancing hand grip and fine motor skills. Better hand grip and fine motor skills contribute to improved control and coordination of movements, leading to more accurate letter formation and spacing. By addressing the underlying issues related to hand grip and fine motor skills, the intervention likely facilitated the development of precise finger movements required for maintaining consistent gaps between letters. As a result,

Child A was able to space the letters more evenly, creating a visually pleasing and organized written output. The improvement in letter spacing is significant as it enhances the overall readability of the written work. Consistent and appropriate letter spacing allows for easier identification and recognition of individual letters and words, reducing the potential for confusion or misinterpretation.

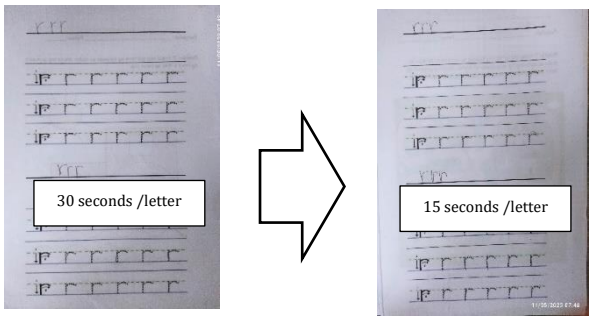


Figure 7. Writing Sample of Child B showing the Improvement with higher speed. Before and After the Intervention with the letter “r”

The description states that Child B demonstrated improvement in writing with the letter "r" in terms of higher time and speed after the intervention. This suggests that Child B became more efficient and proficient in writing the letter "r" within a shorter period of time. The intervention likely focused on enhancing the child's letter formation skills, hand-eye coordination, and motor control. By targeting these areas, the intervention may have facilitated smoother and quicker movements, allowing Child B to write the letter "r" with increased speed. The improvement in writing time and speed is a positive outcome as it indicates that Child B has developed greater dexterity and fluency in executing the writing motion for the letter "r." The intervention's effectiveness in promoting these skills can be attributed to targeted practice, guided instruction, and reinforcement. Based on the Teacher-Journal and progress mark, before the intervention, Child B takes an average of 30 seconds to write the letter "r" legibly and accurately while in the Post-Intervention Measurement, Child B takes an average of 15 seconds to write the letter "r" legibly and accurately. It's important to note that the specific time data and progress can vary for each child and intervention. It's recommended to track the child's progress over multiple sessions or assessments to observe consistent improvement and assess their overall development in writing the letter "r" efficiently and proficiently.

Figure 8 depicts the writing sample of Child C, showcasing the improvement in error reduction before and after the intervention with the letter "r." It is clear that there has been a noticeable decrease in errors associated with writing the letter "r" following the intervention. These errors can include reversals, distortions, or incorrect stroke patterns. Before the intervention, Child C exhibited inconsistencies in the size of the letter "r." However, after the intervention, there is a visible improvement in the uniformity of the letter size. This suggests that the intervention likely focused on teaching the child proper letter formation techniques and encouraged them to apply those techniques consistently.

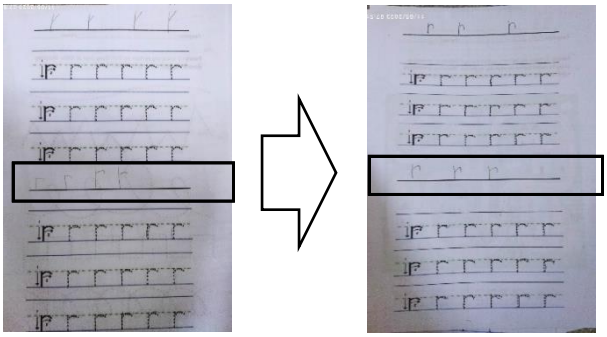


Figure 8. Writing Sample of Child C showing the Improvement in error reduction. Before and After the Intervention with the letter “r”

The reduction in errors signifies that Child C has developed a better understanding of how to form the letter "r" correctly and has improved their ability to apply that knowledge. This indicates progress in their overall writing skills and highlights the effectiveness of the intervention in addressing the specific challenges related to the letter "r." By minimizing errors, Child C is demonstrating increased proficiency in letter formation and a more refined grasp of the proper stroke sequence and structure for writing the letter "r." This improvement is crucial for enhancing legibility, readability, and overall writing fluency. The observed improvements in error reduction and size consistency in Child C's writing sample provide compelling evidence of the positive impact of the intervention. These advancements reinforce the notion that targeted interventions and instruction can significantly contribute to the development of a

child's writing skills, resulting in more accurate and consistent letter formation.

Research has shown that targeted interventions aimed at improving handwriting skills can result in noticeable improvements in letter spacing, speed, and error stroke reduction (Keller, 2013, Monica et al, 2011, López-Escribano, Martín-Babarro, & Pérez-López, 2022, Lee, 2022). However, it is important to note that individual learner characteristics and instructional approaches may influence the effectiveness of interventions Puyjarinet, et al, 2022, Mathwin, Chapparo, & Hinitt, 2023, Mathwin, Chapparo, & Hinnit, 2022). Effective handwriting interventions should include adequate handwriting practice (Kadar et al, 2020, Ray, et al, 2021). Handwriting is an important skill for individuals of all ages and is causally related to both learning to read and learning to write. There are many handwriting issues that are common to see in the classroom, clinic, or home, and these can be addressed with simple strategies, tools, and practice and this study hopes to address the practical gap of handwriting improvement in the Philippine context.

CONCLUSION

In conclusion, this mixed-method study provided valuable insights into the effectiveness of Fine Motor Activities (FMA) and Hand Exercises (HE) interventions, coupled with Instructed Proper Pencil Handling and Grip (IPPHG), in enhancing grade 1 learners' attitudes towards handwriting and improving their motor coordination skills. The study involved 13 participants who received the interventions over a two-week period, with pre- and post-assessments conducted for motor coordination and attitudes towards handwriting. The quantitative results of the study demonstrated a positive impact of the interventions on the learners' attitudes towards handwriting, as evidenced by the improved post-intervention attitude scores. Additionally, the learners showed enhanced motor coordination skills, particularly in fine motor skills, as indicated by the improved post-motor coordination scores measured using the Beery Buktenika VMI. These findings highlight the effectiveness of incorporating FMA, HE, and IPPHG in developing learners' handwriting skills, proper pencil handling and grip, and overall motor skills. In like manner, the qualitative result showed that in the thematic analysis of responses, improved pencil grip, enhanced writing skills, enjoyment and engagement, and positive attitude towards writing and coloring emerged. Based on the qualitative analysis of pupils' writing outputs, the learners have improved handwriting skills as to letter spacing, speed and error stroke reduction. The study's findings emphasize the significance of early interventions and targeted strategies in promoting writing readiness among grade 1 learners. By implementing IPPHG, FMA, and HE approaches, educators and practitioners can effectively enhance learners' attitudes towards handwriting and support the development of their fine motor skills. The large effect size observed in this study further strengthens the argument for the adoption of these interventions in educational settings. By incorporating these interventions into educational curricula, schools can effectively support the development of learners' handwriting skills and promote their overall engagement and success in written tasks.

RECOMMENDATION

Based on the conclusion of this study, the following recommendations are offered, first, as to practical recommendations to effectively implement the findings of this study, it is recommended that educators and practitioners incorporate Fine Motor Activities (FMA) and Hand Exercises (HE) interventions, along with Instructed Proper Pencil Handling and Grip (IPPHG), into early education curricula. This can be achieved by designing lesson plans that integrate these interventions, providing students with opportunities to practice and improve their fine motor skills and handwriting abilities. Additionally, schools should prioritize training and professional development

programs for teachers to ensure they are equipped with the necessary knowledge and skills to implement FMA, HE, and IPPHG effectively. Creating a supportive and engaging learning environment that fosters positive attitudes towards handwriting and fine motor skills development is also crucial. This can be achieved by incorporating fun and interactive activities, providing positive feedback and reinforcement, and promoting collaboration and peer support among students. As to managerial interventions, school administrators play a vital role in supporting the implementation of interventions aimed at enhancing learners' handwriting skills. It is recommended that administrators allocate sufficient resources, including materials, tools, and dedicated spaces, to facilitate the effective implementation of FMA, HE, and IPPHG interventions. This may involve providing schools with appropriate equipment, such as fine motor skill tools and writing materials, and ensuring classrooms are conducive to carrying out these activities. Regular monitoring and assessment of learners' progress in handwriting skills and motor coordination are essential. School administrators should establish systems for tracking and evaluating students' development in these areas, allowing for early identification of students who may require additional support or interventions. Furthermore, promoting collaboration and communication among teachers, occupational therapists, and parents is crucial for creating a holistic and coordinated approach to supporting learners' development. Regular meetings and open channels of communication should be established to share progress, exchange insights, and address individual needs.

And lastly, as to theoretical recommendations, while this study demonstrated the positive impact of FMA, HE, and IPPHG interventions on learners' attitudes towards handwriting and motor coordination skills in a two-week period, further research is warranted to explore the long-term effects. Future studies should investigate the sustainability of these interventions and assess their impact over an extended period, potentially spanning several months or even years. Additionally, a deeper understanding of the specific components within FMA, HE, and IPPHG that contribute most significantly to the observed improvements is necessary. Researchers should conduct more detailed investigations into the underlying mechanisms at play and identify the most effective intervention strategies. Moreover, exploring the generalizability of the findings across different age groups, educational settings, and cultural contexts is essential to ensure the broader applicability and effectiveness of these interventions. Comparative studies involving diverse populations can shed light on potential variations and help refine the interventions for maximum impact.

REFERENCES

Aguilar, M. (2020). Handwriting strategies of Filipino students in a second language. International Journal of English Language Teaching, 8(2), 74-90.

Alves-Wold, A., Walgermo, B. R., McTigue, E., & Uppstad, P. H. (2023). Assessing Writing Motivation: a Systematic Review of K-5 Students' Self-Reports. Educational Psychology Review, 35(1), 24.

Barros, W. M. A., Silva, K. G. D., Silva, R. K. P., Souza, A. P. D. S., Silva, A. B. J. D., Silva, M. R. M., ... & Souza, V. D. O. N. (2022). Effects of overweight/obesity on motor performance in children: a systematic review. Frontiers in Endocrinology, 12, 1798.

Beery, K. E., & Beery, N. A. (2006). The Beery-Buktenica Developmental Test of Visual-Motor Integration: Administration, scoring and teaching manual (5th ed). Minneapolis, MN: Pearson

Belsky, J. (2019). The Lifespan: Human Development for Helping Professionals. Sage Publications

Bouwien C. M. Smits-Engelsman, & Evi Verbecque. (2021). Pediatric care for children with developmental coordination disorder, can we do better? 45(2), 250–264. https://doi.org/10.1016/j.bj.2021.08.008

Breuhl, C. (2016). Impact Of Direct Fine Motor Intervention on Handwriting.https://digitalcommons.lsu.edu/cgi/viewcontent.cgi?article=6208&context=gradschool_theses

Cairney, J., Hay, J. A., Faught, B. E., & Hawes, R. (2005). Developmental coordination disorder and overweight and obesity in children aged 9-14 y. Pediatrics, 116(2), e311-e316. https://doi.org/10.1542/peds.2004-2186

Cairney, J., Hay, J. A., Faught, B. E., & Hawes, R. (2005). Developmental coordination disorder and overweight and obesity in children aged 9-14 y. Pediatrics, 116(2), e311-e316. https://doi.org/10.1542/peds.2004-2186

Department of Education. (2013). K to 12 Curriculum Guide: English. Retrieved from https://www.deped.gov.ph/wp-content/uploads/2014/10/English-CG.pdf

Dinehart, L. H. (2015). Handwriting in early childhood education: Current research and future implications - Laura H Dinehart, 2015. Journal of Early Childhood Literacy. https://journals.sagepub.com/doi/abs/10.1177/1468798414522825?journalCode=ecla

Dinehart, L. H., & Manfra, L. (2013). Associations between low-income children's fine motor skills in preschool and academic performance in second grade. Early Education and Development, 24(2), 138-161.

Escolano-Pérez, E., Maria Luisa Herrero-Nivela, & Losada, J. (2020). Association Between Preschoolers' Specific Fine (But Not Gross) Motor Skills and Later Academic Competencies: Educational Implications. 11. https://doi.org/10.3389/fpsyg.2020.01044

Eva Ose Askvik, Van, & Audrey. (2020). The Importance of Cursive Handwriting Over Typewriting for Learning in the Classroom: A High-Density EEG Study of 12-Year-Old Children and Young Adults. 11. https://doi.org/10.3389/fpsyg.2020.01810

Feder, K. P., & Majnemer, A. (2007). Handwriting development, competency, and intervention. Developmental Medicine & Child Neurology, 49(4), 312–317. https://doi.org/10.1111/j.1469-8749.2007.00312.x

Ferretti, R. P., & Graham, S. (2019). Argumentative writing: Theory, assessment, and instruction. Reading and Writing, 32, 1345-1357.

Fletcher, J. M., Lyon, G. R., Fuchs, L. S., & Barnes, M. A. (2018). Learning disabilities: From identification to intervention. Guilford Publications.

Fuelscher, I., Williams, J., Enticott, P. G., Hyde, C., & Lum, J. A. G. (2018). Manual

dexterity correlates with cognitive control and academic achievement. Neuropsychology, Development, and Cognition. Section B, Aging, Neuropsychology and Cognition, 25(3), 413-431. https://doi.org/10.1080/13825585.2017.1416407

Ganeswara Rao, M., Alhusaini, A. A., & Syamala, B. (2018). Handwriting Performance in Elementary School Children - Teacher and Therapist Viewpoint. Pediatrics & Health Research, 02(01). https://doi.org/10.21767/2574-2817.100010

Gargot, T., Asselborn, T., Zammouri, I., Brunelle, J., Johal, W., Dillenbourg, P., ... & Anzalone, S. M. (2021). "It Is Not the Robot Who Learns, It Is Me." Treating Severe Dysgraphia Using Child–Robot Interaction. Frontiers in Psychiatry, 12, 596055.

Germano, G. D., & Capellini, S. A. (2023). Handwriting fluency, latency, and kinematic in Portuguese writing system: Pilot study with school children from 3rd to 5th grade. Frontiers in Psychology, 13, 1063021.

Goh, C. (2015). Teaching and learning handwriting. In F. Hyland & P. Shaw (Eds.), The Routledge handbook of language learning and teaching (pp. 432-446).

Graham, S. (2018). The role of attitudes and motivation in writing development. In The Oxford Handbook of Writing Development (pp. 187–202). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199936698.013.13

Graham, S. (2020). The sciences of reading and writing must become more fully integrated. Reading Research Quarterly, 55, S35-S44.

Graham, S., & Perin, D. (2007). Writingnext Effective Strategies To Improve Writing Of Adolescents In Middle And High Schools A Report to Carnegie Corporation of New York. https://media.carnegie.org/filer_public/3c/f5/3cf58727-34f4-4140-a014-723a00ac56f7/ccny_report_2007_writing.pdf

Graham, S., Liu, X., Aitken, A., Ng, C., Bartlett, B., Harris, K. R., & Holzapfel, J. (2018). Effectiveness of literacy programs balancing reading and writing instruction: A meta-analysis. Reading Research Quarterly, 53(3), 279-304.

Graham, S., McKeown, D., Kiuhara, S., & Harris, K. R. (2012). A meta-analysis of writing instruction for students in the elementary grades. Journal of Educational Psychology, 104(4), 879–896. https://doi.org/10.1037/a0029185

Haberfehlner, H., de Vries, L., Cup, E. H., de Groot, I. J., Nijhuis-van der Sanden, M. W., & van Hartingsveldt, M. J. (2023). Ready for handwriting? A reference data study on handwriting readiness assessments. Plos one, 18(3), e0282497.

Hands, B., Larkin, D., & Parker, H. (2015). The relationship among physical activity, motor competence and health-related fitness in 14-year-old adolescents. Scandinavian Journal of Medicine & Science in Sports, 25(5), 610–618. https://doi.org/10.1111/sms.12330

Hassan, M., Liu, W., McDonough, D. J., Su, X., & Gao, Z. (2022). Comparative Effectiveness of Physical Activity

Intervention Programs on Motor Skills in Children and Adolescents: A Systematic Review and Network Meta-Analysis. 19(19), 11914–11914. https://doi.org/10.3390/ijerph191911914

Hen-Herbst, L., & Rosenblum, S. (2022). Handwriting and Motor-Related Daily Performance among Adolescents with Dysgraphia and Their Impact on Physical Health-Related Quality of Life. Children, 9(10), 1437.

Hu, N. (2022). Investigating Chinese EFL Learners' Writing Strategies and Emotional Aspects. LEARN Journal: Language Education and Acquisition Research Network, 15(1), 440-468.

Huffman, L. C., & Fortenberry, J. D. (2011). Health promotion in childhood and adolescence for prevention of obesity and eating disorders. In Handbook of Child and Adolescent Obesity (pp. 413-430). Springer, Boston,

James, K. H., & Engelhardt, L. E. (2012). The effects of handwriting experience on functional brain development in pre-literate children. 1(1), 32–42. https://doi.org/10.1016/j.tine.2012.08.001

Jiménez, J. E., de León, S. C., García, E., & Seoane, R. C. (2022). Assessing the efficacy of a Tier 2 early intervention for transcription skills in Spanish elementary school students. Reading and Writing, 1-33.

Johnson, B., Scott, T. M., & McLeod, S. (2017). Attitudes toward writing: Impact of a writing intervention and gender differences. Journal of Educational Research, 110(2), 178–187. https://doi.org/10.1080/00220671.2015.1127694

Kadar, M., Wan Yunus, F., Tan, E., Chai, S. C., Razaob@ Razab, N. A., & Mohamat Kasim, D. H. (2020). A systematic review of occupational therapy intervention for handwriting skills in 4–6 year old children. Australian occupational therapy journal, 67(1), 3-12.

Keller M. (2013). Handwriting Club: Using Sensory Integration Strategies to Improve Handwriting. (2013, April 24). Reading Rockets. https://www.readingrockets.org/article/handwriting-club-using-sensory-integration-strategies-improve-handwriting

Khan, K., & Sharma, K. (2020). Prevalence and Pattern of Handwriting Difficulties among School Going Children. International Journal of Trend in Scientific Research and Development; https://www.semanticscholar.org/paper/Prevalence-and-Pattern-of-Handwriting-Difficulties-Khan-Sharma/0e0ca8941d3dc98672feffc557f9b378fa7e3100

Khoury-Shaheen, R., & Weintraub, N. (2023). Arabic Handwriting Vs. Keyboarding: Performance and Underlying Body Functions Among Elementary-School Students. Journal of Occupational Therapy, Schools, & Early Intervention, 1-15.

Kim, Y. S. G., Yang, D., Reyes, M., & Connor, C. (2021). Writing instruction improves students' writing skills differentially depending on focal instruction and children: A meta-analysis for primary grade students. Educational research review, 34, 100408.

Kunhoth, J., Al Maadeed, S., Saleh, M., & Akbari, Y. (2023). Exploration and

analysis of On-Surface and In-Air handwriting attributes to improve dysgraphia disorder diagnosis in children based on machine learning methods. Biomedical Signal Processing and Control, 83, 104715.

Lee, S. C. (2022). Visual perceptual skills as predictors of handwriting skills of children grades 1-3. Journal of Occupational Therapy, Schools, & Early Intervention, 15(3), 265-273.

Lin, Y.-C., Hsu, C.-H., Lin, C.-L., Hsu, H.-Y., Liu, J., Yeh, C.-H., & Kuo, L.-C. (2022). Pen-grip kinetics in children with and without handwriting difficulties. 17(6), e0270466–e0270466. https://doi.org/10.1371/journal.pone.0270466

López-Escribano, C., Martín-Babarro, J., & Pérez-López, R. (2022). Promoting Handwriting Fluency for Preschool and Elementary-Age Students: Meta-Analysis and Meta-Synthesis of Research From 2000 to 2020. Frontiers in Psychology, 13, 841573.

Lust, C. A., & Donica, D. (2011, September 16). Effectiveness of a Handwriting Readiness Program in Head Start: A Two-Group Controlled Trial. ResearchGate; American Occupational Therapy Association. https://www.researchgate.net/publication/51744388_Effectiveness_of_a_Handwriting_Readiness_Program_in_Head_Start_A_Two-Group_Controlled_Trial

MacDonald, M., Lipscomb, S., McClelland, M., Duncan, R., Becker, D., Anderson, K., & Kile, M. (2016). Relations of preschoolers' visual-motor and object manipulation skills with executive function and social behavior. Research Quarterly for Exercise and Sport, 87(2), 223-233.

Margo van Hartingsveldt, et al. Predictive Validity of Kindergarten Assessments on Handwriting Readiness. Jan. 2015, pp. 114–24, https://doi.org/10.1016/j.ridd.2014.08.014. Accessed 13 June 2023.

Mathwin, K., Chapparo, C., & Hinitt, J. (2023). Children with handwriting difficulties: Impact of cognitive strategy training for acquisition of accurate alphabet-letter-writing. British Journal of Occupational Therapy, 03080226221148413.

Mavilidi, M. F., Okely, A. D., Chandler, P., & Cliff, D. P. (2020). Paediatricians' perspectives on the role of handwriting skill in children's academic performance. BMC Pediatrics, 20(1), 1–10. https://doi.org/10.1186/s12887-020-02144-6

McKeown, D., Wijekumar, K., Owens, J., Harris, K., Graham, S., Lei, P., & FitzPatrick, E. (2023). Professional development for evidence-based writing instruction: Elevating fourth grade outcomes. Contemporary Educational Psychology, 102152.

Monica, Egan, M., & Feder, K. P. (2011). A Systematic Review of Interventions to Improve Handwriting. 78(1), 13–25. https://doi.org/10.2182/cjot.2011.78.1.3

Nightingale, R., Sumner, E., Prunty, M., & Barnett, A. L. (2022). Handwriting and typing: Occupational therapy practice when supporting adolescents with handwriting difficulties. British Journal of Occupational Therapy, 85(11), 891-899.

Pascual, M., Soler, O., & Salas, N. (2023). In a split second: Handwriting pauses in

typical and struggling writers. Frontiers in psychology, 13, 1052264.

Puyjarinet, F., Madramany, P., Autexier, A., Madieu, E., Nesensohn, J., & Biotteau, M. (2022). Psychomotor intervention to improve handwriting skills in children with ADHD: A single-case experimental design with direct inter-subject and systematic replications. Neuropsychological Rehabilitation, 1-27.

Quinn, M. F., & Rohloff, R. (2023). Not just handwriting and spelling: assessing early composing skills. YC Young Children, 78(1), 24-32.

Ralli, A. M., Chrysochoou, E., Giannitsa, A., & Angelaki, S. (2022). Written text production in Greek-speaking children with developmental language disorder and typically developing peers, in relation to their oral language, cognitive, visual-motor coordination, and handwriting skills. Reading and Writing, 35(3), 713-741.

Ray, K., Dally, K., Colyvas, K., & Lane, A. E. (2021). The effects of a whole-class kindergarten handwriting intervention on early reading skills. Reading Research Quarterly, 56, S193-S207.

Ray, K., Dally, K., Rowlandson, L., Tam, K. I., & Lane, A. E. (2022). The relationship of handwriting ability and literacy in kindergarten: a systematic review. Reading and Writing, 1-37.

Rezai, A., Namaziandost, E., & Rahimi, S. (2022). Developmental potential of self-assessment reports for high school students' writing skills: A qualitative study. Teaching English as a Second Language Quarterly (Formerly Journal of Teaching Language Skills), 41(2), 163-203.

Rocha, R. S., Castro, S. L., & Limpo, T. (2022). The role of transcription and executive functions in writing: a longitudinal study in the transition from primary to intermediate Grades. Reading and Writing, 35(8), 1911-1932.

Rosenblum, S., & Livneh-Zirinski, M. (2016). Handwriting performance, self-efficacy, and self-esteem in adolescents. American Journal of Occupational Therapy, 70(5), 7005220010. https://doi.org/10.5014/ajot.2016.019281

Rule, A. C., & Stewart, K. E. (2002). Effects of a motor skill program on the motor proficiency of preschool children. Adapted Physical Activity Quarterly, 19(4), 409-420.

Santangelo, T., & Graham, S. (2016). A comprehensive meta-analysis of handwriting instruction. Educational Psychology Review, 28, 225-265.

Seo, S. (2018). The effect of fine motor skills on handwriting legibility in preschool age children. 30(2), 324–327. https://doi.org/10.1589/jpts.30.324

Sheryl Eckberg Zylstra, & Pfeiffer, B. (2016). Effectiveness of a Handwriting Intervention With At-Risk Kindergarteners. 70(3), 7003220020p1-7003220020p8. https://doi.org/10.5014/ajot.2016.01882

Sheryl Eckberg Zylstra, & Pfeiffer, B. (2016). Effectiveness of a Handwriting Intervention With At-Risk Kindergarteners. 70(3), 7003220020p1-7003220020p8. https://doi.org/10.5014/ajot.2016.018820

Skar, G. B. U., Graham, S., & Huebner, A. (2021). Learning loss during the COVID-19 pandemic and the impact of emergency remote instruction on first grade students' writing: A natural experiment. Journal of Educational Psychology.

Smits-Engelsman, B., & Verbecque, E. (2022). Pediatric care for children with developmental coordination disorder, can we do better?. biomedical journal, 45(2), 250-264.

Swenson, K. (2019). FineMotor, Perceptual Motor, and Handwriting Development in FineMotor, Perceptual Motor, and Handwriting Development in Young Children / Speech, Language, and Musical Development in Young Children / Speech, Language, and Musical Development in Young Children Young Children. https://repository.stcloudstate.edu/cgi/viewcontent.cgi?article=1037&context=cfs_etds

Vander Hart, L., van der Meer, A., & van der Weel, F. R. (2010). Handwriting in early childhood education: Current research and future implications. Journal of Early Childhood Literacy, 10(1), 97–118. https://doi.org/10.1177/1468798409353984

Verywell Family. (2022). Fine and Gross Motor Skills in Children. Retrieved from https://www.verywellfamily.com/what-are-motor-skills-3107058

Yancosek, K. E., & Howell, D. (2011). Systematic review of interventions to improve or augment handwriting ability in adult clients. OTJR: Occupation, Participation and Health, 31(2), 55–63. https://doi.org/10.3928/15394492-20101026-01

Zumbrunn, S., Broda, M., Varier, D., & Conklin, S. (2020). Examining the multidimensional role of self-efficacy for writing on student writing self-regulation and grades in elementary and high school. British Journal of Educational Psychology, 90(3), 580-603.

Zumbrunn, S., Marrs, S., Broda, M., Ekholm, E., DeBusk-Lane, M., & Jackson, L. (2019). Toward a more complete understanding of writing enjoyment: A mixed methods study of elementary students. AERA Open, 5(2), 2332858419850792.