

Relationship between Fine Motor Proficiency and Letter Formation among Pre-Primary 1 Learners in Kakamega East Sub-County, Kakamega County, Kenya

Khaseyi Gillian, Atieno Rose Opiyo

Masinde Muliro University of Science and Technology, Kakamega, Kenya

Abstract: There is a strong link between the physical domains under which there is development of fine motor skills that influence writing outcomes of preschool children. This has probed the need to look at the association between fine motor proficiency and writing outcomes. The purpose of this study was to establish the link between fine motor proficiency as a predictor of writing outcomes among pre-primary 1 learners. The study aimed at establishing the effect of fine motor proficiency on pen-handling, the influence of fine motor proficiency on writing legibility, as well as identification of the relationship between fine motor proficiency and letter formation among pre-primary 1 learners in Kakamega East sub-county, Kakamega County, Kenya. The theoretical framework incorporated two theories; the sociocultural theory of writing and Kepharts theory of visual motor development due to inadequacy of one theory to outline both fine motor proficiency and writing outcomes. The study adopted a survey research design as a means of establishing the relationship between the independent and the dependent variables and the study instruments used were preschool learners' questionnaires which were filled with the help of their parents, teachers-in-charge interview schedules, observation checklists, and document analysis guide. The target population included 6 public pre-schools with 6 ECDE teachers-in-charge who were purposively sampled and 385 pre-primary 1 learners who were sampled using the proportionate sampling method. There was piloting of the study instruments to test for the research protocol. Validity was tested using the content validity method while reliability of the study instruments was tested using the test-retest method. Quantitative and qualitative data was analysed using descriptive statistics, frequencies and their percentages and means from the Statistical Package for Social Sciences (SSPS). Linear regression was used to determine the relationship between the dependent (pen-handling, legible writing, and letter forming) and independent (fine motor proficiency) variables. Data gathered from the research instruments was presented in form of scatter graphs and tables. The findings of the study involved the importance of fine motor proficiency in learners letter formation hence recommendations of the study were the need for teachers and caregivers to ensure learners fine motor proficiency for better handwriting through provision of appropriate materials promoting fine motor skills. The findings and recommendations may be used by education policy makers and the Ministry of Education to come up with appropriate curriculum that will

cater for the fine motor skill needs of pre-school children so as to enhance their writing outcomes.

Key words: Fine motor proficiency, pre-primary 1, letter formation.

I. BACKGROUND

Fine motor proficiency refers to the coordination of small muscles, in movements usually involving the synchronisation of hands and fingers with the eyes thus the complex levels of manual dexterity that humans exhibit can be attributed to and demonstrated in tasks controlled by the nervous system. According to Venetsanou & Kambas (2016), it is well documented that children's participation in physical activity is associated with many health aspects (Binkley & Specker, 2004; Livonen, Saakslanti & Nissinen, 2011). However, recent research findings have revealed that today's children, even the younger ones, seem to be sedentary and present low physical activity (PA) levels (Hinkle et al, 2008). This evidence makes the need for the enhancement of young children's PA apparent, if public health is to be protected. Among the most important factors contributing to PA participation is thought to be children's motor proficiency (Kambas et al 2012) hence, fine motor proficiency is determined by qualitatively different aspects of both gross and fine motor development and serves as an index of children's motor development (Bruinninks, 1978). Thus, if children's optimal motor proficiency is to be achieved and movement programmes are to be planned on the individual needs of each child, the first step for teachers is to be aware of factors affecting motor development and resulting in performance differences. Potential differences among age groups as well as possible gender differences are among the first to be examined (Goodway & Branta, 2003).

On the other hand, letter formation is the ability to form letters of the alphabet correctly thus children need to be taught these skills along a continuum based on their developmental abilities. This is the reason schools teach letter formation together with the sounds of the letters which is the best way to go thus there is a lot of sense in that doing the two together reinforces the sound-symbol-formation association. However, the order of the phonic introduction doesn't correlate with the

optimal letter formation order. The optimal letter formation order is as critical as the optimal order for introduction of phonics hence early grapho-motor skills or pre-handwriting skills have been shown to be a predictor for reading and maths in grade 2 (Dinehart 2017).

Problem Statement

Grouping the teaching of letter formations by the sequence of motor movements that make up the letters can go a long way to reinforcing correct formation patterns hence children who achieve consistent starting positions achieve consistent formation patterns which lead to the establishment of an automatic handwriting script. As young learners begin to write, they aren't always familiar with the capital and lowercase letters thus starting to write those lowercase curvy letters takes fine motor practice especially for those learners who have never picked up a pencil before. Thus, it's the teacher's role to show them the first steps because handwriting is a fundamental skill in writing, and while their writing won't always be completely legible, there are ways to help them practice those fine motor skills.

II. METHODOLOGY

The paper utilised purposive and proportionate sampling techniques to draw a sample of 385 from 10,922 preschool learners and 6 teachers-in-charge from the 97 public preschools in Kakamega East Sub County. Data for the study was generated using a pre-primary 1 questionnaire which were a modification of the Kenya Schools Readiness Assessment Tool (KSRAT) 2015 developed by the Ministry of Education to assess pre-schoolers' readiness in preschools. The study modified the KSRAT tool to measure pre-primary 1 learners proficiency in fine motor skills and writing outcomes using a Likert scale with 5=Excellent; 4=Very Good; 3=Good; 2=Satisfactory; 1=Fair with a maximum score of 50 for each of the items for a given competency. Explanatory data was solicited using teachers-in-charge interview schedules which was designed and self-administered. The teachers-in-charge interview schedules solicited data on pre-school teacher's characteristics relating to their gender, teaching experience, and deployment years.

III. LITERATURE FINDINGS

Fine motor skills are necessary for many aspects of self-care as children, for example; putting on shoes, feeding themselves, cleaning their own teeth thus they are also critical for the development of emergent writing as they have implications for children's engagement in fine arts, drawing and emergent writing experiences. Writing is a complex process that requires the development of language, visual information, grapheme knowledge, word knowledge and concepts of print hence motor control helps in the production of text through drawing, mark-making and symbolic representations of letters which is vital in the communication of the message. Thus, children that are competent movers seem to find their participation in PA and or sports enjoyable

and in so doing form a lifelong association with PA (Barnett et al 2008). However, those with poor movement skills appear to avoid PA (Caine, Kwan, Hay, & Faught, 2012), therefore hindering the development of their skills, a fact that further restricts their participation in PA. This phenomenon, known as 'vicious circle' (Zimmer, 2003), underlines the need for the timely enhancement of children's movement skills. Early childhood comprises an important period in human's life for both his or her development (Gallahue & Donnelly 2003) and the adoption of a physically active lifestyle (Timmons et al., 2012) thus, it should not remain unexploited. Even the smallest movement difficulties a child might have should be identified, so that adequate intervention is implemented and the vicious circle be avoided. Moreover, developmentally appropriate movement programmes should be implemented for young children to become competent movers.

According to Greutman (2017), handwriting is such an important skill to have for future reading, communication and written expression and this is why it is important to make sure the building blocks for handwriting are solid. The most significant fine motor skill that can be connected directly to poor handwriting skills is in-hand manipulation which is the skill of picking up an item and being able to move it around in hands or manipulate it. In some studies, it appeared that in-hand manipulation skills had a significant effect on letter formation, which in turn had an effect on writing tests. Another study done by Timmons et al (2012) looked at children with fine motor delays and those with typically developing fine motor skills found that children with delays had less than efficient in-hand manipulation skills. The children with delays ended up needing more time and dropped items more frequently or required external help for stability in order to complete their writing tasks.

Therefore, it is important to remember that children are still figuring out which hand is dominant between the ages of 2 and 4 and may not fully develop until age 6 hence many are also not ready for handwriting until age 6 or 7. This thus has an effect on how they hold the pencil, as the dynamic tripod grasp is not developmentally appropriate until age 4-6. Thus it is important to rule out all these concerns while addressing handwriting which is why children have to be assessed by a professional like an occupational therapist so they can address all of these areas and find out what exactly could be causing children's handwriting difficulties.

In recent years, there has been a considerable amount of research on the process of writing (MacArthur, Graham, & Fitzgerald, 2006), but this study investigated the writing outcomes. Writing enables individuals to express their knowledge and thoughts (Parush, Liftshitz, Yochman, & Weintraub, 2010); handwriting such as using the hand to form letters on a page is essential in the writing process and can predict the amount and quality of children's written ideas (Edwards, 2003). Even though Graham, Harris and Fink (2000) found handwriting was casually related to writing, little attention has been focused on the instruction of writing

mechanics such as letter formation, size, spelling as a result students are struggling with foundational handwriting skills that affect legibility and untimely writing performance. Thus, writing skills are critical life skills hence there is a strong relationship between kindergarten performance and performance in later academic years which demonstrates the important roles early childhood teachers and related service staff have in affecting writing performance in later years (Clark 2010).

The national Association for the Education of Young Children (1998) reported that a five year range in literacy-related skills were common in a kindergarten classroom for example one kindergartener may be unable to identify any letters of the alphabet while another kindergarten student may enter school well equipped and ready to write. Thus, the link between fine motor skills and handwriting is obvious, but researchers have struggled to identify the motor components that play a crucial role such as the method of holding a pencil was assumed to be linked to the quality of handwriting, but has only been supported in one study of first graders (Schneck, 1991).

According to Seo (2018), handwriting is an important functional task that needs to be performed by children in lower grades of elementary school, and it is an essential ability for academic achievements. However, because the time period in which children attempt handwriting varies according to the maturity of the nervous system, environmental experience, and the level of interest in letters, it is important to verify in the early stages of development whether children have problems in performing the task of handwriting. In order to evaluate the ability of handwriting performance in children, various dimensions must be considered including the domain of handwriting, legibility, speed and ergonomic factors. Among these dimensions, legibility signifies the legibility of their handwriting thus the factors that influence handwriting legibility include the shape of the letters, the size of the letters, the arrangement of the letters, and the amount of space between the letters. Thus before beginning the act of handwriting, children need to develop readiness skills for forming letters such as the comprehensive abilities of various sensorimotor systems, the development of large and small muscles, visual perception, fine motor skills, and in-hand manipulation skills. According to Seo (2018), if children without sufficient development of such readiness skills learn handwriting, they are at risk of developing bad handwriting habits, which may lead to difficulties in developing handwriting legibility. According to previous studies which emphasize the importance of acquiring readiness skills before starting handwriting, there are various factors connected to the issues involved in this study. Among the factor, fine motor skills allow for the demonstration of good handwriting legibility through the ability to control a handwriting tool with speed and accuracy over the course of activities such as fine motor precision, manual dexterity, and in-hand manipulation. As such, fine motor skills are essential for children before developing the repeated behaviour of holding appropriate writing utensils.

According to a study done by Akin (2019), factors such as visual perception show little correlation with handwriting, whereas tactile kinaesthetic, visual motor and motor planning are more closely related to handwriting. Therefore, a proper handwriting requires fine motor skills, visual perception, cognition integration and maturation (Volman et al., 2006; Shams & Kim 2010). Moreover, fine motor skills are important because correctly formed letters can only be produced with force control and proper timing of coordinated finger, hand and arm movements (Alston and Taylor, 1987). Thus, there are many basic skill components that will interfere with handwriting performance and before starting handwriting process; children need to develop preparation skills to form letters such as development of small muscles, visual perception, fine motor skills, and hand manipulation skills (Lamme 1979). According to Akin (2019), when copying letters and words, children need not only keeping the task in mind, attention, visual and manual coordination, but also control of fine movements and enough power of the finger and the hand (Stevenson & Just 2014).

Also, it is seen that motor competence measures related to handwriting production have an indirect effect on handwriting in school age children (Berninger, 2009). Acquiring handwriting skills at the beginning of education is the basis of future academic success (Cahill 2009).

In a study done by Capellini et al (2017), the learning of writing skills depends on visual perception, as it is used to construct internal representations of visual information that provides characteristics such as shape, size, position in space and distance of letters. Motor coordination is responsible to several actions, from sensory grasping to proper sequencing to produce the necessary movements for the expression of written handwriting (Andrade et al 2012; Fusco et al 2011; Okuda et al 2011; Vinter & Chartrel 2010). According to Capellini et al (2017), handwriting requires finely graded manipulation of pencils to produce letter forms, in a fluent and ballistic manner, with a specific orientation and size, in a specific serial order, and in specific positions on a writing surface. Furthermore, according to Sovik & Arntzen (1991), fluent writing is produced by an integrated pattern of coordinated movements subject to visual monitoring and sensorimotor feed-back (Tseng & Chow 2000). Much can also be inferred from the various ways in which handwriters do not achieve functional competence thus handwriting can be deficient either in terms of legibility or in terms of speed. Also, common handwriting problems such as incorrect letter formation, poor alignment, reversals, uneven size of letters, irregular spacing between letters and word, and slow motor speed (Alston & Taylor 1987; Johnson & Carlisle 1996) do not necessarily arise from identical underlying mechanisms thus the relationship between illegibility and various visual-perception skills, fine motor skills and visual-motor integration (Wallen, Duff, Goven & Froude 2013) indicated that automatic handwriting that is legible, generated at sufficient speed and without need for conscious attention is

predicated on effective orthographic-motor integration and not simply on motor processes.

According to Greutman (2017), the most important fine motor skill that can be directly connected to poor handwriting skills is in-hand manipulation which is the skill of picking up an item and being able to move it around in your hand, or manipulate it. In some studies, it appeared that in-hand manipulation skills had a significant effect on letter formation, which in turn had an effect on writing tests. Another study that looked at children with fine motor delays and those with typically developing fine motor skills found that children with delays had less than efficient in-hand manipulation skills (Stevenson & Just 2014). The children with delays ended up needing more time and dropped items more frequently or required external help for stability in order to complete their writing tasks while strong fine motor skills are needed for good pencil grasp, there could also be sensory concerns or visual motor concerns. The visual motor concerns with handwriting include knowing to start from the top to bottom and left to right when forming letters and/or sentences hence it is important to remember that children are still figuring out which hand is dominant between the ages of 2 and 4 and may not fully develop until age 6 thus this will have an effect on how they hold the pencil as the dynamic tripod grasp is not developmentally appropriate until age 4-6.

Fine motor skills are essential skills in writing because they help form letters and numbers accurately and can only be produced by proper timing and force control of coordinated arm, hand, and finger movement. Pienaar et al., (2014) reported a strong relationship between math, reading, writing performance and motor proficiency in boys and girls in disadvantaged children in South Africa. Children with lower motor proficiency had poor performance in these academic areas. Hand strength and visual-motor development can directly affect writing and is found to be more challenging in children from low socioeconomic (SES) backgrounds. A growing body of evidence suggests that early writing helps build code-related skills such as alphabetic knowledge (i.e., letter names and sounds) and phonological awareness, essential to encoding and decoding (Diamond, recognizable written language symbols to communicate thoughts and information (Gombert & Fayol, 1992; Levin, Both-De Vries, Aram, & Bus, 2005; Puranik & Lonigan, 2011; Tolchinsky, 2001).

However, debates and efforts continue around the construction of a model that reflects writing development for this young age group (Juel, Griffith, & Gough, 1986; Puranik & Lonigan, 2014). Early writing (also called emergent or exploratory writing) is a complex construct, comprising a broad range of conceptual knowledge (e.g., print represents speech) and procedural abilities, such as writing letters and beginning to spell words in alphabet languages (Clay, 2001; Molfese et al., 2011; Berninger et al., 2006). Although learning to write certainly involves social and cultural factors (Dyson, 1987; Ferreiro & Teberosky, 1982), it focuses on the

successive appearance of letters and words with the use of a consistent message-level prompt (Bodrova & Leong, 2011). A budding integration of cognitive, linguistic, and motoric processes is evident as young children become symbol-minded and engage in early writing behaviors (Bialystok & Martin, 2003; Clay, 1975). This increasingly coordinated set of abilities is required to recall a specific letter shape from memory and then print a recognizable form along a horizontal line (James, 2017; Longcamp, Zerbato-Poudou, & Velay, 2004). Medium to large correlations were found between letter naming and letter writing skills in studies of preschool and kindergarten (Diamond et al., 2008; Molfese, Beswick, Moinar, & Jacobi-Vessels, 2006; Reutzel, Mohr, & Jones, 2017).

The first letters that children write, often from the meaningful and familiar personal name, represent a milestone in literacy development (Levin et al., 2005). Yet the early phases of name-writing skill may reflect an ability to memorize a logogram, rather than an applied knowledge of letter names or deeper letter-sound correspondence (Blood good, 1999; Levin et al., 2005). As one example, among Dutch preschoolers who could write their name, 80% were able to correctly identify the initial letter but only 37% could identify the second letter (Both-De Vries & Bus, 2010). Further evidence comes from a study of 286 preschool and kindergarteners, which showed that the ability to write several dictated letters, but not name writing. The acquisition of adequate orthographic competences is crucial for the achievement of advanced writing abilities.

Thus, preschool children with better fine motor skills get involved in more diverse activities (Wrotniak et al., 2006; Fisher et al., 2005). This advantage provides them different social interactions resulting in gaining better social skills as well (Özkür, 2019). Past movement experiences become the foundation for interactions and progress in subsequent motor development periods. Consequently, motor proficiency is the result of a long process of development that involves active participation in appropriate developmental activities of the child (Clark, 2007; Barela, 2013). Motor skills lead to the successful exploration of the environment by infants, who construct their knowledge of the world through such behavior (Piaget, 1952). Hence; fine motor skills are also involved in the writing development of learners. Various studies have shown that the experiences of children with self-produced locomotion are related to cognitive abilities such as the permanence of objects and spatial information organization (Bertenthal, Campos, & Kermoian, 1994; Campos et al., 2000). Advances in neuropsychology also provide knowledge based on brain function and structure about the relationship between motor skills and cognition hence when we consider the literacy capabilities of reading and writing, they are structured from cognitive abilities such as visual, phonological and semantic systems (Son & Meisels, 2006). Thus, challenges in literacy skills can be as a result of poor conditions observed in other systems that writing and reading skills are emerged (Rosenbaum, Carlson, & Gilmore, 2001).

Therefore, preschool children are instructed to acquire basic reading and writing literacy skills during preschool education which provides the basis for the achievement of primary school curriculum objectives.

As a matter of fact, handwriting is dependent on “motor, perceptual, cognitive, and linguistic abilities” (Maldarelli, Kahrs, Hunt, & Lockman, 2015) hence, fine motor control, along with the coordination of visual and manual movements, is necessary for children to be able to copy letters. Thus, owing to the fact that many professionals have examined the importance of fine motor, perceptual motor, and handwriting development and the connections between them, this study will focus on the relationship between fine motor proficiency and writing outcomes. This is because attention and executive function, along with future academic success in reading and math, have been linked to fine motor and/or perceptual motor abilities in early childhood (Dinehart & Manfra, 2013; Grissmer et al., 2013; MacDonald et al., 2016; Son & Meisels, 2006; Stewart, Rule, & Giordano, 2007). More specifically, the ability to copy forms (including letters and shapes) had a significant positive effect on math scores for primary school students (Grissmer et al., 2013; Sparks, 2013). Thus, the practice of handwriting may facilitate reading acquisition and letter recognition in young children (James & Engelhardt, 2012; Longcamp, Zerbato-Poudou, & Velay, 2005).

Early handwriting development provides the foundation for proper future writing into the elementary school and beyond which means that handwriting practice in early childhood may enhance letter recognition and formation, which are foundational steps for reading acquisition (James & Engelhardt, 2012; Longcamp et al., 2005). Researchers have linked fine motor, perceptual motor, and writing ability in early childhood to later academic achievement (e.g., reading and math skills) in elementary school (Dinehart, 2015; Dinehart & Manfra, 2013; Gerde, Bingham & Wasik, 2012; Grissmer, Aiyer, Murrah, & Steele, 2010; Son & Meisels, 2006). However this study focused on the link between fine motor proficiency and writing outcomes although other researchers also suggest relationships exist between fine motor and perceptual motor abilities and executive function (Grissmer et al., 2013; MacDonald et al., 2016; Sparks, 2013). According to school specialty (2018), children progress developmentally from a whole hand grasp as infants to a digital pronate grip as toddlers with mature or dynamic tripod grasp developing by about age 6. Research has shown that there are acceptable variations of a mature pencil grasp that do not impact writing speed or legibility. This implies that learners who struggle with writing speed and legibility issues may need to further develop their fine motor skills specifically for the hand muscles.

Handwriting development is usually associated with early childhood and middle childhood academic learning because children are often exposed to handwriting development activities in early childhood settings, kindergarten and beyond. Young children are learning letter awareness and

early writing skills when practicing writing their name and other letters, numbers, lines and shapes hence, the ability to write incorporates a combination of cognitive, motor and neuromotor processing skills (Dinehart, 2015).

Unlike fine motor and perceptual motor development, handwriting development does not begin in infancy, but builds on earlier fine motor and perceptual motor skills which means that for one to write, their fine motor skills should be well formed and developed. Therefore, from a motor standpoint, children need to be able to develop and master whole arm and whole hand movements before moving to the more intricate finger grasping and control required for writing (Huffman & Fortenberry, 2011). Additional prerequisites for handwriting include perceptual motor, neuromotor, cognitive, and linguistic skills (Bara & Gentaz, 2011; Dinehart, 2015).

Hand use is critical to daily life functions, including writing, dressing, and playing. An observation of 10 Head Start and 10 kindergarten classrooms found that kindergarten students spent almost one-half (46%) of their day engaged in fine motor activities while children in Head Start spent over one-third of their day (37%) in fine motor activities (Marr, Cermak, Cohn, & Henderson, 2003). Self-care activities represented 45% of the total fine motor time in Head Start (e.g., opening milk carton, dressing and eating). Manipulating objects represented 44-46% of the total fine motor time in kindergarten and Head Start (e.g., cutting, finger plays, using play dough,). Paper and pencil tasks (e.g., writing, coloring, or painting) 13 represented 42% of the total fine motor time in kindergarten, but only 10% in Head Start.

Children spend almost half of their day engaged in fine motor activities, yet little attention is paid to these tasks in research and teacher training. Typically, children begin to draw and scribble by age 2. These initial attempts at drawing and writing advance through stages as children learn to draw with directionality and begin forming geometric shapes including vertical and horizontal lines, circles, and intersecting lines (Dinehart, 2015). As children progress in their handwriting abilities, they start accurately producing letters and numbers as early as 3 to 4 years of age. Usually, children first learn and practice writing the letters of their name, followed by additional letters, numbers and symbols (Dinehart, 2015). It should be noted that “handwriting acquisition is generally slow and difficult” and, depending on the child’s ability and development, it may take years for a child to become proficient at handwriting (Bara & Gentaz, 2011, p. 746). Hence, fine motor skills are foundational for handwriting development and they depend on muscular control, patience, judgment and coordination (Huffman & Fortenberry, 2011).

Preschool children must therefore know how to write appropriately by first of all learning names of letters, the sounds of the letters, and how to write the letters. Phonemic awareness, which is defined as —conscious attention to phonemes by Richgels, (2003), which includes understanding and manipulating speech sounds, is critical to both the reading and writing processes and if learners do not develop phonemic

awareness, they may have difficulty learning the phoneme-spelling correspondences required to spell and write (Berninger, 2000). Learners' ability to read words is interwoven with their ability to write letters and words (Domico, 1993; Richgels, 1995). Thus, reading and writing are highly similar but they are not identical cognitive processes.

Reading words is much easier than the process of selecting words and then writing them on paper (Fitzgerald & Shanahan, 2000). Majority of the schools provide only reading instruction and assume that students will be able to learn everything needed for handwriting from the reading instruction or simply writing. Yet, handwriting is a learned process and requires instruction for true skill development. Also, the link between fine motor skills and handwriting is obvious, but researchers have struggled to identify the motor components that play a crucial role such as in letter formation was assumed to be linked to the quality of handwriting, but has only been supported in one study of first graders (Schneck, 1991). Other studies have found that the pattern of letter formation does not have a significant effect on writing outcomes (Bergmann, 1990; Burton & Dancisak, 2000; Dennis & Swinth, 1999; Roston, Hinojosa, & Kaplan, 2008; Zivaini & Wallen, 2006; Zivaini & Wilkins, 1986). Hence, research on handwriting skills, especially factors that predict letter formation, appears frequently in the literature for students in primary grades (grades 1-3). This implies that poor hand writers have difficulty producing well formed letters and words that can be read by the teacher, resulting in lower grades and poor academic performance.

A study by Grissmer et al. (2010) that examined the impact of fine motor skills and later academic achievement indicated that early fine motor skills are a "strong and consistent predictor of later achievement". Other research findings indicate that fine motor development in early childhood is potentially linked to cognitive development.

IV. CONCLUSIONS

Generally studies on the relationship between fine motor skills and letter formation are pointing to the fact that schools are offering only reading instruction and assuming that learners will be able to learn everything that is necessary for handwriting. They tend to forget that writing is a learned process which requires instruction for true skill development thus the link between fine motor skills and handwriting is obvious. In this case, researchers have struggled to identify the motor components necessary in letter formation which is connected to the quality of handwriting.

Moreover, learners with poor handwriting have difficulties producing well formed letters and words which make it difficult for others to read. This is attributed to poor fine motor proficiency which results in poor academic performance. On the other hand, learners who are proficient in fine motor skills tend to have good letter formation making it easy for one to read their written work thus good academic performance.

V. RECOMMENDATIONS

Therefore, teachers and caregivers are tasked with the role of ensuring learners' fine motor proficiency for better handwriting through provision of appropriate materials promoting fine motor skills.

Teachers and caregivers should also offer a variety of fine motor activities and assess learners writing skills and abilities so as to offer a helping hand to ensure learners have good writing outcomes for better future academic performance.

REFERENCES

- [1] Akin, S. (2019). Fine Motor Skills, Writing Skills and Physical Education Based Assistive Intervention Program in Children at Grade 1. *Asian Journal of Education and Training*, 5(4), 518-525.
- [2] Cameron, C. E., Brock, L. L., Murrain, W. M., Bell, L. H., Worzalla, S. L., Grissmer, D., & Morrison, F. J. (2012). Fine motor skills and executive function both contribute to kindergarten achievement. *Child development*, 83(4), 1229-1244.
- [3] Clark, G. J. (2010). The relationship between handwriting, reading, fine motor and visual-motor skills in kindergarteners.
- [4] Gallahue, D. L., & Donnelly, F. C. (2007). *Developmental physical education for all children*. Human Kinetics.
- [5] Goodway, J. D., & Branta, C. F. (2003). Influence of a motor skill intervention on fundamental motor skill development of disadvantaged preschool children. *Research quarterly for exercise and sport*, 74(1), 36-46.
- [6] Graham, S., Harris, K. R., & Fink, B. (2000). Is handwriting causally related to learning to write? Treatment of handwriting problems in beginning writers. *Journal of educational psychology*, 92(4), 620.
- [7] Greutman, H. (2017). *Basics of fine motor skills: developmental activities for kids*. Growing Hands-on Kids, LLC.
- [8] Livonen, S., Sääkslahti, A., & Nissinen, K. (2011). The development of fundamental motor skills of four-to five-year-old preschool children and the effects of a preschool physical education curriculum. *Early Child Development and Care*, 181(3), 335-343.
- [9] Julius, M. S., Meir, R., Shechter-Nissim, Z., & Adi-Japha, E. (2016). Children's ability to learn a motor skill is related to handwriting and reading proficiency. *Learning and Individual Differences*, 51, 265-272.
- [10] Kambas, A., Michalopoulou, M., Fatouros, I. G., Christoforidis, C., Manthou, E., Giannakidou, D. & Zimmer, R. (2012). The relationship between motor proficiency and pedometer-determined physical activity in young children. *Pediatric exercise science*, 24(1), 34-44.
- [11] Molfese, V. J., Beswick, J. L., Jacobi-Vessels, J. L., Armstrong, N. E., Culver, B. L., White, J. M., ... & Molfese, D. L. (2011). Evidence of alphabetic knowledge in writing: Connections to letter and word identification skills in preschool and kindergarten. *Reading and Writing*, 24(2), 133-150.
- [12] Parush, S., Lifshitz, N., Yochman, A., & Weintraub, N. (2010). Relationships between handwriting components and underlying perceptual-motor functions among students during copying and dictation tasks. *OTJR: Occupation, Participation and Health*, 30(1), 39-48.
- [13] Pienaar, A. E., Barhorst, R., & Twisk, J. W. R. (2014). Relationships between academic performance, SES school type and perceptual-motor skills in first grade South African learners: NW-CHILD study. *Child: care, health and development*, 40(3), 370-378.
- [14] Puranik, C. S., Lonigan, C. J., & Kim, Y. S. (2011). Contributions of emergent literacy skills to name writing, letter writing, and spelling in preschool children. *Early childhood research quarterly*, 26(4), 465-474.

- [15] Seo, S. M. (2018). The effect of fine motor skills on handwriting legibility in preschool age children. *Journal of physical therapy science*, 30(2), 324-327.
- [16] Tseng, M. H., & Chow, S. M. (2000). Perceptual-motor function of school-age children with slow handwriting speed. *American Journal of Occupational Therapy*, 54(1), 83-88.
- [17] Venetsanou, F., & Kambas, A. (2016). Motor proficiency in young children: A closer look at potential gender differences. *Sage Open*, 6(1), 2158244015626226.