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Fine motor activities as contributing factors to the improvement of children handwriting fluency, handwriting quality and drawing skills

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Abstract

It is evident that early age skills are crucial for the later academic achievement. The purpose of this research was to examine the effect of using fine motor activities on children hand writing fluency, hand writing quality and drawing skills. The participants were 24 KG three children. A within-subjects experimental design, in which all participants exposed to experimental condition, was used. Before experimental treatment, children were thought through conventional method to write letters, words and to draw pictures. Then, as pretest children handwriting fluency, handwriting quality and drawing skills were assessed. During the treatment, children were involved in fine-motor play training. In the training, children were allowed to use fine-motor practices by using handwriting controller, and different group play techniques. As posttest, children were provided assessments which were intended to measure their skills in writing and drawing. The results were analyzed by statistical software SPSS. Specifically, Paired sample – T test and descriptive statistics were used. Results from paired sample- t test showed that there was a statistically significant difference between teaching through conventional method and involving children in fine motor activities. Children handwriting quality, handwriting fluency drawing skills, and interest in group play were improved after they practice in fine-motor activities. A straight forward implication of this study is that fine motor activities can contribute significantly to children writing, drawing and social skills. Therefore, teachers are recommended to use fine motor activities in teaching children and using their world of play as place of teaching. In addition, toy factories are recommended to produce play materials from plastic which can contribute to the development of children writing, drawing and social skills.

Key words: *Fine motor, handwriting skills, drawing skills, social skills, and hand-movement controller*

Introduction

It is evident that early childhood care and education is a time when the foundation of future life established. Developmentally appropriate practice is required to stimulate the development of children in all aspect. According to recent research, effective fine motor skills are essential for kindergarten success (Ohl et al., 2013). Fine motor skills refer to the small muscles in the hands and fingers that are responsible for tasks such as picking objects up and grasping a pencil.

Children use fine motor skills in school with tasks such as cutting and pasting, using manipulative in mathematics, or clapping their hands to learn syllables (Cameron et al., 2012).

Fine Motor development and its association with academic achievement and social interaction is one of the concerns of researchers in early childhood education (Berninger, 2000; Berninger et al., 2006; Bart, Hajami, & Bar-Haim, 2007, Keifer, 2011). The association between physical activity, cognition, and academic achievement were studied in recent years (Hilman et.al., 2008, Tomporowski et.al., 2008, Haapala et.al., 2014 Donelly et.al., 2016) Delay in fine motor skills acquisition is often the main reason for school children's handwriting difficulties (Berninger, 2000; Berninger et al., 2006). Since writing is not expected in preschool and kindergarten, handwriting problems are thus discussed in the field of early literacy research and early childhood education. Poor handwriting also related to children's fine motor skills. Volman, van Schendel, and Johgmans (2006) compared 29 children (Grade 2 and Grade 3) with handwriting problems and 20 children without handwriting problem and found that children with handwriting problems scored significantly lower on visual perception, visual–motor integration, and fine motor coordination in comparison with the children in the control group.

A positive association was also found between motor functions and academic performance in children. A large-sample study showed that self-reported physical activity and obesity mediated the association between parent reported childhood motor function and academic achievement at age 16 (Kantomaa MT., et.al., 2013). Moreover, another study involving daily physical education and motor practice showed that children with motor skill deficits performed worse in academic tests than children with no deficits. Importantly, another study also demonstrated that daily physical education (PE) and motor skill training during the compulsory school years not only led to improved motor skills but was also accompanied by improved school performance in adolescence (Ericsson I., et.al., 2014). Thus, this research was intended to measure the effect of fine motor activity on children handwriting and drawing skills. The study was conducted by using experimental method.

Statement of the problem

Handwriting helps a child develop crucial motor skills. Preschool is a proper time, in the development of a child, to teach fine motor skills. One of these skills, that is commonly taught at this age is handwriting (McFarland, 2015). Research suggests that kindergarten students spend a significant portion of the school day (46%) performing a variety of fine motor activities such as eating, coloring, cutting, and writing (Marr, Cermak, Cohn, & Henderson, 2003). By the end of the year, kindergarten students, who have had practice developing their hand muscles with activities such as writing, drawing, painting, and working with clay, should have more developed fine motor skills (Copple & Bredekamp, 2009). Other activities commonly used in kindergarten to improve fine motor skills are sorting small objects, stringing beads, zipping, buttoning, tying clothing, using scissors, and pouring (Copple & Bredekamp, 2009). However, these fine motor activities are broad and not specific to academic skills such as handwriting quality and fluency.

It became clear that in the current time of technological advancement, the focus on handwriting had died away through in spite of its great importance. The spread of technology lead children to be machine dependents that they cannot make resolutions without using any and hence, the teaching process does not encourage students to write, and this leads to the decay of their academic performance (Al-Ghabra, 2015). Thus, handwriting is a neglected aspect of the academic learning process. The real problem is that the machine became smarter than humans who do not know the basics of literate life without using at least one machine (Al-Ghabra, 2015). Hence, this study was intended to design fine motor activities. The aim of fine motor activities is twofold: first, fine motor activities in the present study intended to attract children like that of technology and at the same. Second, being in the world of children, fine motor activities of this research intended to enhance academic skills such as handwriting and drawing skills. Thus, specific interventions were planned and implemented to help children strengthen their fine motor skills to improve their handwriting and drawing skills.

Objectives

General objectives

To measure the effect of fine motor activities on children writing quality, fluency and drawing skills

Specific Objective

1. To measure the contribution of handwriting controller on writing quality and fluency
2. To measure the contribution of using oiled paper on children handwriting quality and fluency
3. To measure the contributions of group play on children handwriting quality and fluency
4. To measure the contribution of coloring picture and drawing on oiled paper on drawing quality

Significance of the study

The result of this study would help (1) preprimary school teachers by introducing different fine motor activities which related to handwriting; (2) School owners and principals by showing required fine motor materials (3) factory owners showing type of play materials they could produce in their factory.

1.1. Delimitation of the study

Methodologically the study was delimited to children fine motor activities and their link with handwriting and drawing skills.

1.2. Definition of basic terms

The following basic terms were used in the study accordingly:-

- *Fine motor activity*: small motor skills refer to movement skills that use the small muscles of the hands for writing, and drawing.
- *Handwriting quality*: ability of correctly coping words from one paper on another paper with, constant size of letters, following straight line when copying words, Correct relative height of letters, Sufficient word/letter spacing, Regularities in joining letters, Unambiguous letter forms, and Correct use of upper and lower cases.
- *Handwriting fluency*: total number of letters copied per total time
- *Drawing skill*: ability of correctly copying picture on separate sheet which was measured on 5 rating scales.

- *Hand drawing controller: a locally prepared letter writing material in which children trace in the letter.*
- *Oiled paper: a paper which immersed in oil and used as transparent and a paper on which children practice writing and drawing on.*

2. Review of related Literature

2.1. Fine motor skills

Fine motor skills are one of the keys to success in school work. McHale and Cermak (1992) analyzed the minute-by-minute record of one whole day's activities in six elementary school classrooms and found that 30 to 60 percent of the day involved fine motor activities, and moreover, writing tasks predominating over other tasks. Fine motor skills are the coordination of a group of small muscles and are needed to perform daily functions, for examples: dressing (lacing, buttoning, zipping), coloring, knitting, printing and writing, cutting with scissor, picking up small objects, folding paper, and playing with musical instruments (Berninger, 2000; Berninger et al., 2006).

There are three main areas that need to be developed in order to increase students' fine motor development: cutting, writing/drawing, and manipulation of small objects. In each area there are a variety of activities used to develop each skill (Strevig, 2009). Writing/drawing starts out with open ended activities and slowly develops into tracing, copying, and creating with different writing instruments.

2.2. Relationship of fine motor activity and hand writing

Delay in fine motor skills acquisition is often the main reason for school children's handwriting difficulties (Berninger, 2000; Berninger et al., 2006). Since writing is not expected in preschool and kindergarten, handwriting problems are thus discussed in the field of early literacy research and early childhood education.Poor handwriting also relates to children's fine motor skills. Volman, van Schendel, and Johgmans (2006) compared 29 children (Grade 2 and Grade 3) with handwriting problems and 20 children without handwriting problem and found that children with handwriting problems scored significantly lower on visual perception, visual–motor integration, and fine motor coordination in comparison with the children in the control group.

Since writing is not a focus in preschool and kindergarten, handwriting problems are rarely discussed. Handwriting ability has been long overlooked when assessing young children's writing development. After exploring all the factors (e.g., children's social economic status, home background, school curriculum), Dunsmuir and Blatchford (2004) found that the major factor influencing kindergartener' writing performance is their writing attitude and their competence in writing, which both are strongly affected by the children's handwriting ability.

According to Olsen and Knapton (2013), kindergarten is the crucial year to teach good handwriting habits. Writing requires fine motor skills with the hands as well as hand-eye coordination (Grissmer et al., 2010).

2.3. Importance of handwriting

Literacy - the ability to read and write – is recognized as being one of the *most fundamental* of core skills contributing to academic achievement, lifelong learning and sustainable development. Of all the

core competencies recognized to contribute to lifelong learning and sustainable development, none is quite as central as the ability to read and write. Research from around the world demonstrates that literacy is fundamental to success in the formal education system. Literacy links closely to sustainable development as well; multiple links exist between literacy and citizenship, cultural identity, socio-economic development, human rights and equity (*Trudell et.al., 2012)*

James and Engelhardt (2012) have conducted a study to watch the different degrees of brain activation due to handwriting and typing. It has shown that the activated regions in the brain through handwriting are more than those are activated through typing. This gives prior importance to handwriting for mental letter recognition. The earlier that children master the skill of handwriting, the more likely they are to succeed in school (Olsen & Knapton, 2013). Writing is important because it is a basic skill that is incorporated into all subject areas as well as homework, tests, note taking, and classroom assignments (Spear-Swerling, 2006).

Peverly et al. (2013) have carried out their study to evaluate handwriting speed as one of a group of factors that have their effect on the performance of college students. The study has uncovered the importance of speedy handwriting for positive quality and quantity fulfillment of different kinds of writing among children and adults. Motor skills are benefitted by handwriting practice, we need to make sure that we are also maintaining this skill with daily practice and letting the child enjoy and discover these benefits on his/her own (McFarland, 2015).

Typical fine motor tests include tasks such as drawing with a pencil to copy an image, drawing to create an original image, or spatial organization such as building with blocks (Cameron et al., 2012). Researchers Cameron et al. (2012) used such tests with preschool aged children and found that children's ability to use fine motor skills to copy designs was strongly associated with gains in decoding, comprehension, and overall reading once they entered kindergarten. Fine motor skills are essential to kindergarten performance as well as predictive of later achievement and therefore require immediate intervention when a concern arises (Ohl et al., 2013).

2.4. Hand writing and academic achievement

Writing is an especially important area of communication and fine motor development in kindergarten. At this age, children develop an increased desire to communicate effectively (Keifer, 2011). Among the fine motor skills, handwriting skill is no doubt the most important one in academic learning. Handwriting has been a formal lesson in elementary school since the eighteenth century (Ediger, 2002). Handwriting involves visual motor control ability which allows the child to correctly print out the letters forms s/he perceives, visual motor coordination which helps the child to coordinate hand muscles to print the lines and shapes of the letters, and proper hand grasp strength for child to hold and operate writing tools. Children who lack fine motor skills, notably design copy skills, are likely to fall behind in other academic areas (Cameron et al., 2012).

Hence, handwriting is better for students than typing to gain more information; this is confirmed by Alleyene (2011). In

his article, Alleyene states that handwriting lets the information stick in the brain rather than typing. James and Engelhardt (2012) assure that handwriting is important for the mental perception of letters. They have conducted a research on 15 children to see the difference of brain activation during letter perception between the children who experience letter writing and those who experience letter typing. Academic performance is the main concern of educators all over the world. Researchers have studied the importance of handwriting for improving students' performance, and they have proved that using the hand in writing activates many regions in the brain that are related to memory and comprehension (Al-Ghabra, 2015). No doubt fingers send messages to the mind as they move in writing; the repeated movement of hand in writing helps in memorization. Al-Ghabra, 2015

We often consider the development of motor skills as separate from cognitive development, and the terminology itself clearly separates these functions. However, motor and cognitive development may be fundamentally interrelated. In order for cognitive processes to have functional implications, these must influence and be influenced by our actions and thus engage the motor system and perceptual functions. Conversely, cognitive processes may assist decision making, motor control and motor skill learning processes (Geertsen SS, 2016). Cognitive and motor functions display equally protracted time courses during development, and in the event that cognitive development is perturbed (e.g. by neurological disorders), motor development is often also adversely affected [Diamond A., et.al., 2000]. In recent years, it has been demonstrated that many tasks require parallel activation of cognitive-motor circuitries encompassing the prefrontal cortex, the striatum and the cerebellum, and not only can the prefrontal cortex influence motor control, but the cerebellum may also be important for cognitive functions [Diamond A., et.al., 2000].

Lack of mature fine motor skills, especially the skills related to handwriting, has been one of the major concerns in elementary children's academic failure (Ediger, 2002; Graham, Harris, & Fink, 2000; Hooper, 2009). Research has shown that school children with better handwriting skills. Handwriting is beneficial for the brain. It has been suggested that handwriting may activate brain activity in young children (Education Week, 2012, p.2). For the brain to reach its "optimal efficiency" it is necessary to learn handwriting (Klemm, 2013, p. 1). When a student is writing it has been shown that "multiple areas of the brain become co-activated during the learning of cursive...as opposed to typing or just visual practice" (Klemm, 2013, p. 1). The brain is not just charged, or activated; it forms connections that offer high level thinking skills. Brain scans have revealed that children exhibit processing that is almost adult-like when they are writing, as opposed to when they are typing (Education Week, 2012, p.2). How could we ignore such a beneficial skill? Furthermore, when a child is taught to write in a way that is active rather than passive, his/her brain is impacted and their writing legibility and fluency will be enhanced (Seton, 2012, p. 3).

Handwriting is a powerful tool that aids in Memory. Active activities like handwriting have been proven to help a child retain more, whereas passive

activities like typing or tracing cannot promise the same results. "The instructional method affects how the child's brain stores the memory" (Seton, 2012, p. 8). For young children the memorization of how to form letter shapes is key. Typing alone cannot teach this process. The practice of actually making the letter shapes by hand is needed to help the brain remember how to form the letters and duplicate them later. Typing is confusing to teach young children when they are beginning to write, because hitting a key on the keyboard has nothing to do with the actual shape or formation of a letter (Stevensen & Just, 2012, p. 53). Memory is also helped when a student takes notes by handwriting them. This process causes the student not to just write down words verbatim, but rather to analyze the words and synthesize them into a summary that they then write down. This extra processing helps the student better remember the subject on which they were taking notes on (Smoker et al., 2009, p.1744). This has also been shown to be true for word memorization. If the students write them, instead of merely studying them, they retain more. This is true with students learning to type as well. "The increased kinesthetic information from handwriting creates a more complex memory trace than by typing" (Smoker et al., 2009, p. 1746). In addition, it has also been said that when we do not teach handwriting, "reader comprehension may suffer" (Summit to make a Case for Handwriting, 2012). Without handwriting practice, many areas of a child's academic growth are deterred. Handwriting is an excellent and necessary aid in increasing memory.

Peverly et al. (2013) refer to the importance of speedy handwriting for taking notes which are considered an effective aid for the personal memory. Since the information is usually quickly forgotten, note-takers need to write it quickly before it is forgotten. Thus, teachers must put the speed of writing in their consideration when they teach and assess writing.

Different educational and neuro-scientific researches on handwriting have shown that it has its real impact on memory activation and information recalling due to fingers movement. They have also confirmed that handwriting let the information stick in the brain and last more time than typing (Peverly et al., 2013).

3. Methods of Research

3.1. Population and sample

The study was conducted in Mekane Iyesus kindergarten, a faith based KG school found in Mettu town. In the selected school, there was one class of KG three. There were 24 children found in the class. Then all children were included in the study.

3.2. Research design

A within-subject experimental design, in which all participants exposed to experimental condition, was used. All 24 children were assessed in pretest, provided intervention and finally assessed in posttest. There were four experiments conducted in the study and described as follows:

3.2.1. Experiment One: Contribution of Handwriting Controller on Handwriting Quality and Fluency

As shown figure 1 below hand-controller was prepared to help children's handwriting skills improvement. It was prepared according to the following steps.

First, letters were printed (fig.1a) and cut-out from paper. Second, letters which cut out from paper copied on pieces of wood and then tinted with fluid glue (fig.1b). Third, sand was added on tinted letters and kept in sun light (fig.1c). finally, dried hand-controlled smoothed with grease (fig1 d1,d2,d3).

a b c d1

Figure 1

d2 d3

Experimental procedures

During pretest, children were given lists of words to copy on another paper. After their handwriting quality and fluency measured they were given time to practice in handwriting controller. This was intervention time. After intervention, children were given lists of words to copy on another paper like that of pretest. Then, their handwriting quality and fluency of posttest was measured and compared with that of pretest.

3.2.2. Experiment Two: Contribution of Practice of Using oiled paper on handwriting fluency and quality

This experiment was designed by using printed words and oiled paper. The oiled was paper used as transparent and at the same time it also used as the paper on which they copy the reflected words.

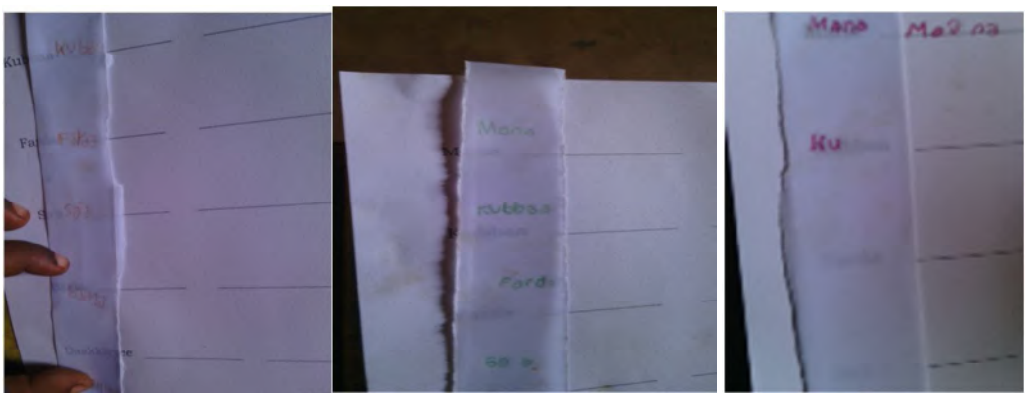


Figure 2

Experimental Procedures

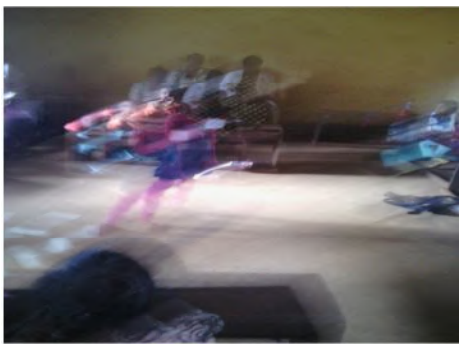
As shown in the above tables, the procedures of this experiment are as follows. First, words were printed and children were given printed words to copy on another paper. Then, their handwriting quality and fluency were measured. This was pretest of the experiment. Second, children were given time to practice on oiled paper repeatedly. Finally as posttest, children were given lists of word and allowed to copy on another paper. Finally, handwriting quality and fluency of pretest and posttest were compared together.

3.2.3. Experiment Three: Contribution of practicing writing in group play on handwriting fluency and quality

In this experiment the major objective was involving children in group play to improve their handwriting quality and fluency. The written words were attached on pieces of wood and mixed.

a

b




c Figure 3 d

Experimental procedures

The experiment was conducted according to the following procedures. During Pretest, children were given lists of words to copy on another paper. Next, during intervention, six procedures were applied. First, words were printed and attached on pieces of woods. Second, children seating were arranged and put like O shape. Third, the mixed words turned down to the floor and children were asked to have seat. Fourth, one children among the group randomly asked to pick out one word randomly from the mixed words and other children were asked to read the selected word. Fifth, children were asked to clamp their hands three times highly. Sixth, they were asked to copy fluently and neatly to write the selected words. During posttest, children were simply given lists of words to copy on another paper and their handwriting quality and fluency were measured.

3.2.4. Experiment Four: Contribution of coloring picture and using oiled paper on children drawing skills improvement.

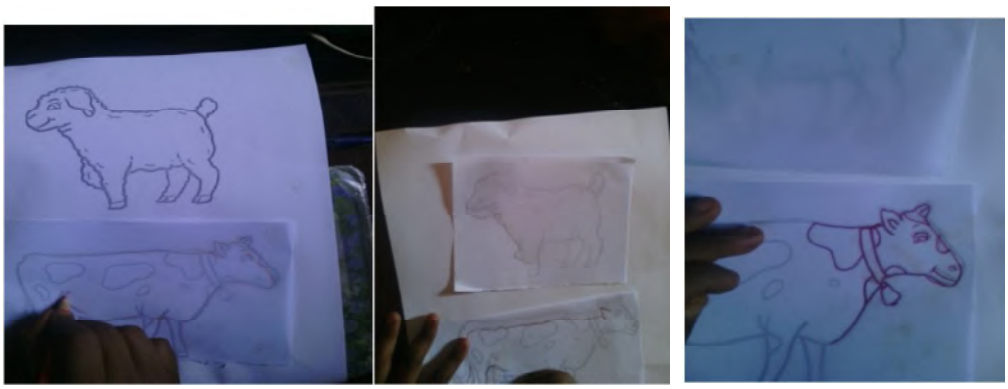



Figure 4

3.3. Data analysis procedure

Data which were collected from each four experimental design were analyzed using SPSS. Paired t-test was employed. The mean difference between pretest and posttest were measured.

4. Results and Discussions

4.1. Experiment One: Contribution of Handwriting Controller on Handwriting Quality and Fluency

In this experiment, children's handwriting quality and fluency were assessed. As a pretest, they were provided group of words to copy from one paper on another paper. Then, they were given handwriting controller to practice writing some of the words which were used at pretest. Finally, after intervention, the same words were given for children to copy from one paper on another paper. This was taken as posttest and children's handwriting quality and fluency were measured and the outputs of the results are discussed as follows.

4.1.1. Contribution of Handwriting Controller on Handwriting Quality

There are two tables presented below. Table 1A shows the descriptive statistics of children handwriting quality before and after using handwriting controller. As indicted in table 1A, the mean score of children handwriting quality after they practice in handwriting quality ($M = 20.63, S = 17.54$) was greater than that of pretest ($M = 17.54, S = 2.67$). Table 1B on the other hand shows paired samples t- test which was calculated to see whether there is significant difference between pretest and posttest.

Table 1A: Contribution of Handwriting Controller on Handwriting Quality (Descriptive statistics)

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	17.5417	24	2.66995	.54500
	Posttest	20.6250	24	3.33379	.68051

Table 1B: Contribution of Handwriting Controller on Handwriting Quality (Paired Samples t-test)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pretest - Post test	-3.08333	1.28255	.26180	-3.62491	-2.54176	-11.777	23	.000

As indicated in table 1B, a paired-samples test was calculated to compare the mean pretest score to the mean posttest score. The mean on the pretest was 17.54 (SD: 2.67), and the mean on the post test was 20.63 (SD: 3.33). A significant increase from pretest to post test was found (t(23) : -11.78, $p < .001$).

The result revealed that, after children practice writing in handwriting controller, their handwriting quality became improved significantly.

4.1.2. Contribution of Handwriting Controller on writing fluency

In the same experiment with handwriting controller, children handwriting fluency was measured before and after use of handwriting controller. Table 1C shows descriptive statistics, whereas table 1D shows comparison of pretest and posttest by using paired samples t-test.

Table 1C Contribution of Handwriting Controller on Handwriting Fluency (Descriptive statistics)

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	6.1667	24	.86811	.17720
	Posttest	8.6250	24	.87539	.17869

Table 1D: Contribution of Handwriting Controller on Handwriting Fluency (Paired Samples t-test)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pretest - Posttest	-2.45833	.83297	.17003	-2.81007	-2.10660	-14.458	23	.000

A paired-samples test was also calculated to compare handwriting fluency of children before and after they practice in handwriting controller. The mean on the pretest was 17.54 (SD: 2.67), and the mean on the post test was 20.63 (SD: 3.33). A significant increase from pretest to post test was found (t (23): -11.78, p < .001). The result indicated that, the contribution of handwriting controller was significant. Practicing in handwriting controller, their handwriting fluency became increased significantly.

4.2. Experiment Two: Contribution of Practice of Using oiled paper on handwriting fluency and quality

In this experiment, children were provided lists of words to copy group of words and their handwriting fluency and quality were measured as pretest. Then, oiled paper was given for children to write on the oiled paper by putting oiled paper on each word as shown in figure ---. Finally, children were given the same words with pretest and their handwriting quality and fluency were measured and discussed in the following sections.

4.2.1. Contribution of Practice of Using oiled paper on handwriting fluency

In this section, descriptive statistics and paired samples t-test were calculated on children handwriting fluency. Table 2A indicates the mean score of children handwriting fluency before and after the experiment. Table 2B shows test of statistical significance difference between pretest and posttest score.

Table 2A: Contribution of use of oiled paper on handwriting quality (Descriptive statistics)

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 Pretest	17.4583	24	2.66995	.54500
Posttest	18.9583	24	3.02855	.61820

Table 2B: Contribution of use of oiled paper on handwriting quality (Paired Samples t-test)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pretest - Posttest	-1.50000	1.02151	.20851	-1.93134	-1.06866	-7.194	23	.000

In table 2A and 2B, a descriptive and a paired-samples test were calculated to compare the mean difference of pretest score to the mean posttest score. The mean on the pretest was 17.46 (SD: 2.67), and the mean on the post test was 18.96 (SD: 3.03). A significant increase from pretest to post test was found (t (23): -7.19, p < .001). The result indicated that when children practice writing by using oiled paper, it improves significantly their handwriting quality.

4.2.2. Contribution of Practice of Using oiled paper on children handwriting fluency

This section also concerned with the test of contribution of using oiled paper on children writing skills. Table 2C shows descriptive statistics of both pretest and posttest. Table 2D shows the outputs of paired samples t-test in which mean difference of pretest and posttest are measured.

Table 2C: Contribution of using oiled paper on handwriting fluency (Descriptive statistics)

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	6.3333	24	.76139	.15542
	Posttest	9.4583	24	1.17877	.24061

Table 2D: Contribution of using oiled paper on handwriting fluency (Paired Samples t-test)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pretest - Posttest	-3.12500	.79741	.16277	-3.46172	-2.78828	-19.199	23	.000

As indicated in table 2C and 3D above, practicing with oiled paper significantly improves their handwriting fluency. A paired-samples test was calculated to compare the mean pretest score to the mean posttest score. The mean on the

pretest was 6.33 (SD: 0.76), and the mean on the post test was 9.46 (SD: 1.19). A significant increase from pretest to post test was found (t(23): -19.199, p < .001). The result shows that, children's handwriting fluency became improved significantly when they practiced on oiled paper.

4.3. Experiment Three: Contribution of practicing writing in group play on handwriting fluency and quality

In this experiment children were grouped and allowed to play together using fine motor activities. Their seating arrangement was circular. Words were written independently on square piece of wood and reversed down. One of them was allowed to pick up one among the words. Showing the words to other children, he/she asks them to read aloud the word. Then, three children randomly selected to sit in front of other children and compete with each other to write the selected words. The same procedure was repeated to compete with all children together. Finally, the same words were given for children to copy on other required space of paper. Then their handwriting fluency and quality were measured.

4.3.1. Contribution of practicing writing in group play on handwriting fluency

In this section two tables were discussed. Table 3A gives the result of pretest and posttest descriptive statistics. Whereas, table 3B shows comparison of mean score of pretest and posttest.

Table 3A: Contribution of using group play on handwriting fluency (Descriptive statistics)

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 Pretest	6.0833	24	.82970	.16936
Posttest	7.6250	24	1.20911	.24681

Table 3B: Contribution of using group play on handwriting fluency (Paired Samples t-test)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pretest – Posttest	-1.54167	1.02062	.20833	-1.97264	-1.11070	-7.400	23	.000

As indicated in table 3A and 3B, involving children to write in group play improve significantly their handwriting fluency. A paired-samples test was used to compare the mean pretest score to the mean posttest score. The mean on the pretest was 6.08 (SD: .83), and the mean on the post test was 7.63 (SD: 1.21). A significant increase from pretest to post test was found (t(23) : -7.40, p < .001). The result indicated that group play significantly improved handwriting fluency.

4.3.2. Contribution of using group play on children handwriting quality

In this section contribution of group play on children learning was analyzed. Table 3C shows descriptive statistics of pretest and posttest scores. Whereas, table 3D shows, the test of paired samples t-test between pretest and posttest.

Table 3C: Contribution of using group play on handwriting quality (Descriptive statistics)

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	17.4583	24	2.84344	.58041
	Posttest	18.3333	24	2.91423	.59487

Table 3D: Contribution of using group play on handwriting quality (Paired Samples t-test)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pretest - Post test	-.87500	.74089	.15123	-1.18785	-.56215	-5.786	23	.000

Table 3C and 3D indicate that, children handwriting quality improved as a result of implementing fine motor activity in group play. A paired-sample test was calculated to compare the mean pretest score to the mean final exam score. The mean on the pretest was 17.46 (SD: 2.84), and the mean on the post test was 18.33 (SD: 2.91). A significant increase from pretest to final was found (t (23): -5 .77, p < .001). The above results showed that group plays significantly improve handwriting quality.

Moreover, children also demonstrated pro-social behavior and self-control when engaged in group play. Teachers also attested that before experiment, children frequently had been asking permission to escape from the class to urinate. However, during the experiment children were eagerly participated in group play.

4.4. Experiment Four: Contribution of coloring picture and using oiled paper on children drawing skills improvement.

In this experiment children were given pictures to draw on separate paper. Their drawing quality then measured and scored as pretest. During intervention, children were provided opportunity to practice drawing. They were given colors to color pictures and oiled paper to draw on pictures. Finally, children were given pictures to draw on another paper and their drawing quality were measured and scored as posttest.

4.4.1. Contribution of coloring pictures on drawing quality

In this section, contribution of coloring pictures on children drawing quality was measured in comparison of pretest with that of posttest. Table 4A shows descriptive statistics of pretest and posttest. Table 4B shows comparison of mean difference of pretest and posttest.

Table 4A: Contribution of coloring on drawing quality (Descriptive statistics)

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	2.9375	24	.90063	.18384
	Posttest	3.3125	24	.70422	.14375

Table 4B: Contribution of coloring on drawing quality (Paired Samples t-test)

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pretest Posttest	--.37500	.33783	.06896	-.51765	-.23235	-5.438	23	.000

As indicated in table 4A and 4B, coloring pictures significantly improve their drawing quality. A paired-samples test was used to compare the mean pretest score to the mean posttest score. The mean on the pretest was 2.94 (SD: .90), and the mean on the post test was 3.31 (SD: 0.70). A significant increase from pretest to post test was found (t(23) : -5.44, p < .001). The above results indicated that when children allowed to practice in coloring pictures it improve significantly their drawing quality.

4.4.2. Contribution of practicing with oiled paper on drawing quality

The contribution of using oiled paper on children drawing quality was measured in the following section. Table 4c shows descriptive statistics of pretest and posttest; whereas table 4B shows comparison of mean difference of pretest and posttest.

Table 4C: Contribution of using oiled paper on drawing quality (Descriptive statistics)

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	2.9375	24	.90063	.18384
	Posttest	4.0417	24	.76495	.15614

Table 4D: Contribution of using oiled paper on drawing quality (Paired Samples t-test)

Paired Samples Test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Pretest Posttest	--1.10417	.57064	.11648	-1.34513	-.86321	-9.479	23	.000

As indicated in table 4C and 4D, practicing drawing by using oiled paper significantly improve their drawing quality. A paired-samples test was used to compare the mean pretest score to the mean posttest score. The mean on the pretest was 2.94 (SD: .90), and the mean on the post test was 4.04 (SD: .76). A significant increase from pretest to post test was found (t (23): -9.48, p < .001). The above results indicated that allowing children to practice drawing by using oiled paper improve significantly their drawing quality.

4.5. Discussions

4.5.1. Contribution of fine motor activities such as using hand-controller, oiled paper and group play on children handwriting quality and fluency

The findings from this study support the previous findings that fine motor skill development has a positive impact on children handwriting skills in the kindergarten classroom. The results

showed that fine motor activity particularly writing with handwriting - controller significantly contribute to the improvement of children handwriting quality and fluency. The result supported the previous research results of Mangen and Velay (2010) which had stated tracing letters is important for children to improve their writing because they can focus only on drawing letters. Another research by Longcamp et al. (2005) confirmed that hand movements have their considerable role in drawing letters, and they suggest that handwriting helps the visual recognition of letters.

The data from this study supports the previous research which revealed that when students participate in fine motor specific interventions their handwriting improves. (Keifer, 2015) As demonstrated in the study of (Geertsen SS., et.al 2016) and as supported by this research, there is clear association between fine motor skills and speed of writing. Although kindergarten classrooms were rich with fine motor activities, carefully constructed and coached activities were more effective in improving pincer grasp, one aspect associated with fine motor development (Ohl et al., 2013). It is proved in the present research also that carefully planned fine motor activities such as play with handwriting-controller, and oiled paper significantly improve children handwriting skills. This also supported by another research, Keifer (2015) which states the more time that students had to develop their fine motor muscles through interventions, the more their handwriting improved. The reason that handwriting instruction is crucial to kindergarten is because once handwriting is developed students are able to spend more time developing core writing skills, which are foundational literacy skills. When students participate in fine motor specific interventions their handwriting improves. (Keifer, 2015)

4.5.2. Contribution of fine motor activities such as coloring and using oiled paper on children drawing skills

As indicated in the present research, fine motor activity such as coloring pictures and using oiled paper significantly improves children drawing skills.

4.5.3. Contribution of fine motor activities such as writing/drawing on children behavior.

The present research also revealed that, fine motor activity contributed to pro-social behavior, self-control, and task oriented behaviors. This were also supported with the previous finding which showed that, good motor abilities co-occur with better social skills and task-oriented behaviors in class (Pagani, L.S. & Messier, S., 2012). As shown in present research, children who are active in fine motor activity are usually more joyful and cooperative and more willing to share and take turns.

5. Conclusion

The children were involved in fine motor activities with academic purpose such as handwriting quality, fluency and drawing skills improvement. There were four experiments conducted in this research. In the first experiment, children were provided handwriting- controller and allowed to practice writing. The result indicated that, handwriting controller significantly improve children handwriting quality and fluency. In the second experiment, children were provided oiled paper to practice writing. The result showed that, writing on oiled paper significantly improves children's handwriting quality and fluency. The

third experiment concerned with group play which aimed to improve children handwriting quality and fluency. The results indicate that, group play with aim of writing improves children handwriting quality and fluency significantly. In the fourth experiment, children were given fine motor activities such as coloring pictures and using oiled paper to draw in order to improve children drawing skills. The result showed that, their drawing skills were improved after they engaged in fine motor activities. Finally beside the improvement of handwriting quality, fluency and drawing skills, children positive behaviors were also enhanced as a result of fine motor activities. Some of the behaviors that were observed are: 1) pro-social behavior such as helping others, communicating with one another, competing with others and the like, 2) self-control, being engaged in activities for a long minutes and 3) task oriented behavior were observed.

Recommendation

Based on the above results the following suggestions were drawn:

- Teachers should use fine motor activities in teaching children writing and drawing. If what teachers teach in the classroom linked with fine motor activities, it could improve their academic skills meaningfully.
- All concerned bodies should contribute to enhance children fine motor activities by fulfilling required materials
- Toy factories are recommended to produce play materials:

✓ Handwriting controller from simple wood and plastic which are freely movable from place to place.

✓ Very thin paper which can be used as transparent and on which children can write and draw.

Author Declaration about the study

This research is my original work and the procedures of the experiments were original.

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