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Megan Haan

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Abstract

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by

Megan Haan

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Abstract

This action research project investigated the impact on handwriting by the use of stability balls as chairs. The participants were nineteen students in an experimental group and nineteen students in a control group in two different classrooms. Students in both groups were given a pre-test using the "Handwriting Without Tears Screener of Handwriting." The students in the experimental group were taught how to use a stability ball as a chair and used a ball as a chair for twelve weeks. During this time, both classrooms taught the same amount of letters using the *Handwriting Without Tears* curriculum. All students then were given a post-test using the same assessment tool. The results of this study suggested that some areas of handwriting were moderately improved with the use of a ball chair.

Introduction

Handwriting is a foundational skill that is essential to everyday life. At a young age, students start learning the formation of letters and how to put those letters together to form written communication. Students become successful at handwriting by strengthening their fine motor skills. The amount of time spent using fine motor skills during the academic day ranges from 31% to 60% in an elementary classroom, with writing tasks being the predominant activities (McHale & Cermak, 1992). Fine motor skills are defined as a task that requires major use of one's hands (McHale & Cermak, 1992). When children can fluently and legibly write, they are able to focus on the content of what they are writing and are able to effectively communicate (*Handwriting Without Tears*, 2013).

There are many factors that influence the legibility of handwriting. Biomechanical ergonomic factors like body positioning can significantly differ between proficient writers and nonproficient writers (Rosenblum, Godlstrand, & Parush, 2006). Understanding how the body does work (i.e. handwriting), can lead individuals to better assess why certain children may be nonproficient writers (Rosenblum, Godlstrand, & Parush, 2006). In a study done by Smith-Zurovksy and Exner (2004), children were tested while seated in optimal positions (i.e. feet flat on the floor, desks at elbow height) and suboptimal positions (i.e. sitting in a seat that was too large or too small). This study proved that six- and seven-year-olds who were positioned optimally scored better on a test that measures hand manipulation than the children who were positioned suboptimally (Smith-Zurovsky & Exner, 2004).

Since studies like the one done by McHale and Cermak (1992) state that a large portion of an elementary child's school day involves use of fine motor skills, factors that influence those skills, like posture and seating, should be researched (Smith-Zurovsky & Exner, 2004). To allow controlled movement needed for fine motor activities, the human body must have a stable center from which the head and limbs can move (Smith-Zurovksy & Exner, 2004). This suggests that appropriate seating can influence a child's postural control and how he or she effectively uses his or her hands (Smith-Zurovksy & Exner, 2004). Effective use of the limbs and hands allow for better control of writing materials. Teachers of students in early elementary grades need to consider ways to positively impact a student's posture and seating so that handwriting will be positively impacted.

One way that this may be addressed is by the use of a stability ball as a replacement for a standard classroom chair. A stability ball is a piece of equipment that was originally used in occupational and physical therapy for patients with orthopedic and neurological problems, but has been incorporated into classroom settings as an alternative seating option (Witt, 2001). The use of a stability ball has been shown to improve strength, range of motion, flexibility, proprioception, and posture, and has now been incorporated into many classrooms around the United States and across the world (Witt, 2001).

In a study done by the founder of WittFitt, Inc., (2001) stability balls were found to improve balance. When a person sits on a stability ball, the body is activating core muscles. By using those core muscles the body is able to improve its posture. As previously stated, better posture has been found to positive influence

handwriting (Rosenblum, Goldstand, & Parush, 2006). Since there are links between improved posture and proficient handwriting, this study seeks to explore the effects of using a stability ball on handwriting proficiency in an elementary classroom.

Problem

The purpose of this study is to determine if the use of a stability ball as a chair in a Kindergarten classroom is effective in improving handwriting. Although it is known that elementary students spend a large percentage of their day using handwriting and that posture is linked to proficient handwriting, there are few studies that have looked into using alternative seating as a way to improve handwriting. Like the study done by Smith-Zurovsky and Exner (2004), research was done on how the type of seating impacts the writing assessment given to Kindergarten students. Since little research has been done to document the influence of using a stability ball as a chair on handwriting, this study explored handwriting taught in two Kindergarten classrooms, one of which used stability balls for seating.

Research Questions

1) Is there a difference in handwriting development in students who use a stability ball as a chair and those who do not use a stability ball as a chair?

2) Does the use of a stability ball as a chair improve the handwriting of a student over the course of time?

Definitions of Terms

For the purpose of this study, the following definitions will be used. Unless otherwise noted, the definitions are those of the author.

Handwriting – the use of one's hands to produce written language with a writing utensil

Handwriting Without Tears – a handwriting curriculum

" Screener of Handwriting Proficiency" – a handwriting assessment created by the company that measures handwriting proficiency in the areas of memory, placement, and orientation

Memory – the ability to remember and write dictated letters and numbers (Screener of Handwriting Proficiency Scoring Packet – K, 2009)

Orientation – the ability to write letters and numbers facing the correct direction (Screener of Handwriting Proficiency Scoring Packet – K, 2009)

Placement – the ability to place letters and numbers correctly on a baseline (Screener of Handwriting Proficiency Scoring Packet – K, 2009)

Stability Ball – an enlarged rubber ball that is used in physical therapy that may also be used as a chair

WittFitt – a company that produces stability balls for the classroom

Literature Review

In a typical Kindergarten class, children spend 46% of their day on fine motor tasks (Marr, Cermak, Cohn, & Henderson, 2003). The majority of that time is spent on pencil and paper activities. When children enter Kindergarten they are expected to perform academic tasks that involve writing. Illegible handwriting can

create obstacles to accomplishing higher order skills (Feder & Majnemer, 2007). There are many factors that contribute to proficient handwriting, one of which is body posture and positioning (Feder, & Majnemer, 2007; Rosenblum, Goldstand, & Parush, 2006; Smith-Zurovsky & Exner, 2004). One way to improve body posture and positioning is by replacing a standard classroom chair with a stability ball (Kafka & Limberg, 2013; Witt, 2001). The purpose of this study is to determine if the use of a stability ball in place of a standard classroom chair improves handwriting in Kindergarten students.

Time Spent on Fine Motor Activities and Handwriting

Three different studies have been done to determine the amount of time spent on fine motor activities as well as handwriting in elementary classrooms. Asher (2006) conducted a study on handwriting instruction by surveying 47 Kindergarten through grade six teachers. Based on that survey, the researcher found that 20-60 minutes per week were spent on teaching handwriting in a Kindergarten classroom. In a study done by McHale and Cermak (1992), a minute-by-minute record was taken, noting the number of fine motor tasks completed in six different elementary classrooms. Descriptions of the activities were recorded along with the start and stop times. A fine motor task was defined as the major use of one's hands. Based on the observations, the researcher found that 31-60% of the academic day used fine motor activities with ten percent of that time spent on pencil and paper activities.

One more study conducted by Marr, Cermak, Cohn, and Henderson (2003) compared the time spent on fine motor activities in a head start classroom and a

Kindergarten classroom. Results showed that Kindergarten children spent 36%-66% of their day on fine motor activities with 42% of that involving paper and pencil activities. Together these three studies highlight the amount of time spent on both fine motor activities and handwriting.

Fine motor activities are included in daily activities, education, play, and social participation (Marr, Cermak, Cohn, & Henderson, 2003). One of the most common fine motor activities is handwriting. With fine motor activities and handwriting being so prevalent, failure to produce efficient handwriting may have negative effects on academic success and self-esteem (Feder, & Majnemer, 2007). Errors made when in Kindergarten can lead to struggles later in both reading and handwriting (Feder & Majnemer, 2007). Writing difficulties may also have connections to lower math achievement, lower verbal IQ, and attention issues (Feder & Majnemer, 2007). If students struggle with handwriting, they may not produce adequate proof that they understand material, which may lead teachers to assume a child does not know concepts or skills (McHale & Cermak, 1992). As children grow older, the amount of work that is required also increases and if children have writing difficulties, it may be difficult to keep up.

Postural Control

Numerous research studies have explored the idea of postural control being an important aspect of efficient handwriting. An article written by Feder and Majnemar (2007) explains that extrinsic factors like sitting position, chair and desk height, and writing instruments directly affect handwriting. This report stated that the proper sitting position includes feet flat on the floor, knees flexed at 90 degrees,

elbows flexed, and forearms resting on the table. Rosenblum, Goldstand, and Parush (2006) conducted a study where 100 students were evaluated on handwriting based on biomechanical ergonomic factors, handwriting quality, and efficiency. This study found that body positioning is a significant factor in determining handwriting performance. Another finding of this study was that poor body positioning not only affects quality performance but also attention, which is needed to perform and learn handwriting tasks (Rosenblum, Goldstand, and Parush, 2006).

Another study conducted by Smith-Zuzovsky and Exner (2004) tested the IQ of two groups of children where one group used appropriate seating and the other group used seating that was too large for them. This study found that the children who were optimally positioned scored significantly higher than those who were seated in furniture that was too large.

Stability Balls

Several studies have looked at the effects of using stability balls as classroom seating. Witt (2001) conducted a study that focused on many different benefits of using a stability ball as a classroom chair. These benefits include improved flexibility and range of motion, improved strength and stability, improved balance, improved posture, and increased ability to stay on task. Students were pre- and post-tested using motor tests including toe touches, trunk rotation, bent-knee push-ups, tandem heel-toe walking, single-foot standing balance, and pivot prone. Students were also observed by video recording to assess squirminess, time on task, and classroom posture. After 15 weeks of time on the ball, Witt found that every student improved in at least one of the seven tests and two out of twelve students improved in six

tests. When assessed on classroom posture, Witt found that seven students improved, five students showed no improvement, and no students decreased in posture assessments.

Kafka and Limberg (2013), which surveyed 62 teachers on the use of stability balls. One quarter of the respondents said they had used stability balls in the past and 22% were currently using stability balls in the classroom. The researchers found that all of the teachers who had implemented stability balls as chairs found them effective as an intervention. Kafka and Limberg noted that sitting on a stability ball activates postural muscle control resulting in better hand coordination.

Gamache-Hulsman (2007) also conducted a study on the use of stability balls in the classroom, addressing the issue of handwriting directly. After two and a half months of using the stability balls, students improved by 78% between the pre- and post-tests on handwriting quality. The researcher noted general handwriting improvement in the students after the use of the stability ball.

The literature on handwriting in general and the use of stability balls in particular seems to indicate that a connection can be made between the amount of time spent on handwriting in an elementary classroom, the importance of handwriting, the influence of posture on handwriting, and how stability balls can improve posture. Since handwriting makes up a large portion of the elementary student's day, teachers should work to make sure that they are supporting their learners with seating that can improve range of motion and postural control. This study works to explore this idea by comparing two Kindergarten classrooms and

their rate of growth in handwriting after using standard classroom chairs or stability balls.

Methods

Participants

The participants of this study are thirty-eight Kindergarten students from two separate classrooms in a small Christian school. One classroom served as the control group and the other received the treatment of using stability balls as chairs. The control group has ten boys and nine girls, and the treatment group has nine boys and ten girls. The mean age of the participants is five years. The participants are generally from middle class families. Most of the participants are Caucasian with two African American students and two Hispanic students.

Materials

To assess the quality and improvement of handwriting of the two groups, participants took the "Handwriting Without Tears Screener of Handwriting Proficiency", which is included in Appendix A. A team of occupational therapists and educators developed the "Screener of Handwriting Proficiency." The screener can be found at www.hwtears.com and is free to educators. The screener "Administrator Packet" gives step-by-step instructions on how to administer the screener to a class. The test took approximately twenty minutes to administer. The administrator scored the test and the results were entered into an online scoring tool on the Handwriting Without Tears website. This tool calculated percentages for memory, orientation, and placement based on benchmarks appropriate to grade level. A class report and an individual student report helps a teacher to analyze the data by

providing a graphing indicating where the majority of the class falls in comparison to the benchmarks. This screening tool was used because both classrooms use the *Handwriting Without Tears* curriculum for handwriting.

The treatment group in this study used WittFitt stability balls as chairs. Lisa Witt, who is an educator with experience in teaching both elementary and middle school students, developed WittFitt balls. Each student in the treatment group sat on a green, 42 centimeter rubber exercise ball with four pegs on the bottom for stability. The researcher was trained on how to implement the balls into the classroom and had had two years of previous experience before this study. The students were trained on how to use a ball chair before they were given one as a seat. Parents were also given information about the ball chairs and signed a permission slip explaining the use and potential dangers of using a ball chair in the classroom (Appendices B and C).

Research Design

The independent variable of this experiment is the use of the ball chairs in a Kindergarten classroom. In the classroom of the treatment group, the participants were given a ball chair instead of a standard classroom chair to use as a seat during the school day. The participants used the ball chair for twelve weeks between the pre- and post-tests.

The dependent variable of this experiment is represented by the pre- and post-tests of the "Handwriting Without Tears Screener of Handwriting Proficiency." Some limitations of this experiment are the non-randomly assigned groups and the use of two different teachers in the teaching of the handwriting curriculum.

However, the two teachers cover the same material and use the same curriculum and handwriting workbooks. Because of the use of two different teachers, additional limitations include differences in classroom management, environmental differences, and varying types of additional support students may have been receiving in the classroom for handwriting.

Procedure

In order to determine the effect of using stability balls as chairs on handwriting, the total score on the "Handwriting Without Tears Screener of Handwriting Proficiency" was used to make comparisons between the control group and the treatment group. The two Kindergarten classrooms both took a pre- and post-test using the "Screener of Handwriting Proficiency." The administrators used the procedure guidelines for administrating the test so that it was done in a similar fashion for both classes. The test took approximately twenty minutes. The pre- and post-test were scheduled twelve weeks apart.

After the pre-test was given to the treatment group, the participants were trained on the use of the stability balls as chairs using the WittFitt training guidelines. Both classrooms were taught the same amount of letters during the time frame and used the same materials. An occupational therapist who routinely works with the school did the scoring of the pre- and post-tests following the *Handwriting Without Tears* scoring guidelines.

Results

Data Analysis

At the end of the twelve-week time period, the data from the pre- and post-tests were reviewed to find the growth of handwriting among the participants. The test breaks down handwriting into three different categories: memory, orientation, and placement. The test also gives an overall percentage score based on the percentages of each section. A *t* test was used to compare the scores to see if there were any significant differences between the treatment group and the control group. A further exploration of each section was conducted to see if there was an impact. The results were used to determine whether the use of stability balls improved the handwriting in the treatment group.

Findings

Research Question One

The first research question asked the following: Is there a difference in handwriting development among students who use a stability ball as a chair and those who do not use a stability ball as a chair? In order to answer this question, the researcher first needed to find a baseline for handwriting in both the experimental and control group. To do this, the researcher used the "Handwriting Without Tears Screener of Handwriting Proficiency" as a pre-test. This was given to both the experimental group and the control group in the beginning of October.

At this time, both groups were not using stability balls as chairs. This assessment broke down the scores for each student into three categories and gave each student a total percentage score. The assessment first scores letters and

numbers for memory, then placement, and then orientation. An NA score was assigned if a student scored low in memory. The results of the pre-test for the experimental group are shown in Table 1, and the pre-test results are shown for the control group in Table 2. Both assessments were scored by an occupational therapist for consistency.

Table 1
Experimental Group Pre-Test Percentages

Student	**Memory**	**Orientation**	**Placement**	**Total**
1	58.00	83.00	71.00	70.67
2	58.00	82.00	57.00	65.67
3	75.00	93.00	78.00	82.00
4	75.00	93.00	89.00	85.67
5	87.00	89.00	52.00	76.00
6	71.00	100.00	76.00	82.33
7	75.00	94.00	67.00	78.67
8	67.00	79.00	50.00	65.33
9	100.00	86.00	67.00	84.33
10	87.00	68.00	86.00	80.33
11	62.00	85.00	67.00	71.33
12	42.00	NA	NA	42.00
13	33.00	NA	NA	33.00
14	50.00	82.00	83.00	71.67
15	75.00	94.00	56.00	75.00
16	58.00	100.00	86.00	81.33
17	71.00	87.00	76.00	78.00
18	83.00	59.00	75.00	72.33
Average	68.17	85.88	71.00	71.98

Table 2
Control Group Pre-Test Percentages

Pretest	Memory	Orientation	Placement	Total
1	79.00	94.00	37.00	70.00
2	79.00	75.00	68.00	74.00
3	100.00	71.00	96.00	89.00
4	87.00	83.00	90.00	86.67
5	96.00	90.00	78.00	88.00
6	58.00	100.00	64.00	74.00
7	75.00	69.00	83.00	75.67
8	100.00	81.00	71.00	84.00
9	71.00	86.00	29.00	62.00
10	87.00	83.00	48.00	72.67
11	46.00	NA	NA	46.00
12	79.00	100.00	68.00	82.33
13	83.00	100.00	70.00	84.33
14	71.00	79.00	94.00	81.33
15	25.00	NA	NA	25.00
16	46.00	NA	NA	46.00
17	92.00	100.00	82.00	91.33
18	67.00	100.00	62.00	76.33
19	50.00	100.00	58.00	69.33
Average	73.21	88.19	68.63	72.53

When the scores were recorded, data revealed an average of all of the test sections for both the experimental group and the control group. The average is listed at the bottom of each set of test scores in both Table 1 and Table 2.

After the pre-test was conducted and scored for both groups, the researcher introduced the stability balls to the experimental group. The participants were taught how to use the stability balls as classroom chairs. During this time both groups were receiving similar instruction in handwriting using the *Handwriting Without Tears Kindergarten* curriculum. Both groups were taught the same letters during the same weeks.

After a twelve-week period, both groups were given a post-test to determine growth in handwriting. Each group was given the same "Handwriting Without Tears Screener of Handwriting Proficiency" as the post-test. The tests were scored by the same occupational therapist for consistency. The results of the post-test for the experimental group are shown in Table 3, and the results for the control group are shown in Table 4.

Table 3
Experimental Group Post-Test Percentages

Student	**Memory**	**Orientation**	**Placement**	**Total**
1	87.00	61.00	86.00	78.00
2	87.00	100.00	62.00	83.00
3	87.00	89.00	90.00	88.67
4	83.00	88.00	70.00	80.33
5	100.00	100.00	83.00	94.33
6	83.00	100.00	85.00	89.33
7	83.00	100.00	80.00	87.67
8	92.00	89.00	50.00	77.00
9	83.00	94.00	60.00	79.00
10	87.00	83.00	86.00	85.33
11	96.00	95.00	43.00	78.00
12	100.00	100.00	50.00	83.33
13	83.00	88.00	55.00	75.33
14	87.00	100.00	48.00	78.33
15	100.00	100.00	62.00	87.33
16	92.00	95.00	86.00	91.00
17	83.00	82.00	85.00	83.33
18	79.00	71.00	58.00	69.33
Average	88.44	90.83	68.83	82.70

Table 4
Control Group Post-Test Percentages

Student	Memory	Orientation	Placement	Total
1	79.00	100.00	53.00	77.33
2				
3	92.00	79.00	68.00	79.67
4				
5	92.00	95.00	95.00	94.00
6	100.00	100.00	71.00	90.33
7	75.00	69.00	78.00	74.00
8	92.00	100.00	55.00	82.33
9				
10	96.00	100.00	61.00	85.67
11				
12	100.00	100.00	75.00	91.67
13				
14	96.00	100.00	57.00	84.33
15				
16	83.00	94.00	45.00	74.00
17	100.00	100.00	67.00	89.00
18	75.00	93.00	78.00	82.00
19	92.00	100.00	45.00	79.00
Average	90.15	94.62	65.23	83.33

Again, after the scores were recorded, the researcher computed the averages of each section for both the experimental group and the control group. The averages are shown at the bottom of Table 3 and Table 4.

When the post-test was given in December, a number of participants from the control group were absent due to illness. Therefore, students 2, 4, 9, 11, 13, and 15 from the control group do not have a post-test score.

After both the pre-test and post-test were recorded, the researcher calculated the growth score for each student and test section for both the experimental group and control group. These scores are shown in Tables 5 and 6 below.

Table 5
Experimental Group Growth Scores Percentages

Student	Memory Growth	Orientation Growth	Placement Growth	Total Growth
1	29.00	-22.00	15.00	7.33
2	29.00	18.00	5.00	17.33
3	12.00	-4.00	12.00	6.67
4	8.00	-5.00	-19.00	-5.33
5	13.00	11.00	31.00	18.33
6	12.00	0.00	9.00	7.00
7	8.00	6.00	13.00	9.00
8	25.00	10.00	0.00	11.67
9	-17.00	8.00	-7.00	-5.33
10	0.00	15.00	0.00	5.00
11	34.00	10.00	-24.00	6.67
12	58.00			58.00
13	50.00			50.00
14	37.00	18.00	-35.00	6.67
15	25.00	6.00	6.00	12.33
16	34.00	-5.00	0.00	9.67
17	12.00	-5.00	9.00	5.33
18	-4.00	12.00	-17.00	-3.00
Average	20.28	4.56	-0.13	12.07

Table 6
Control Group Growth Scores Percentages

Student	Memory Growth	Orientation Growth	Placement Growth	Total Growth
1	0.00	6.00	16.00	7.33
2				
3	-8.00	8.00	-28.00	-9.33
4				
5	-4.00	5.00	17.00	6.00
6	42.00	0.00	7.00	16.33
7	0.00	0.00	-5.00	-1.67
8	-8.00	19.00	-16.00	-1.67
9				
10	9.00	17.00	13.00	13.00
11				
12	21.00	0.00	7.00	9.33
13				
14	25.00	21.00	-37.00	3.00
15				
16	37.00			28.00
17	8.00	0.00	-15.00	-2.33
18	8.00	-7.00	16.00	5.67
19	42.00	0.00	-13.00	9.67
Average	13.23	5.75	-3.17	6.41

Students who received an NA score during the pre-test in orientation or placement did not receive a growth score, which is represented by a blank space. The students in the control group who were absent during the post-test also did not receive a growth score, which is represented by a blank space.

After the growth scores were found for both the experimental group and the control group, each section of the assessment (memory, orientation, placement and total) was compared using a *t* test. The results of these tests are represented in Tables 7, 8, 9 and 10 below.

Table 7
Memory Growth Comparison and t Test

Student	Experimental Memory Growth	Control Memory Growth
1	29.00	0.00
2	29.00	
3	12.00	-8.00
4	8.00	
5	13.00	-4.00
6	12.00	42.00
7	8.00	0.00
8	25.00	-8.00
9	-17.00	
10	0.00	9.00
11	34.00	
12	58.00	21.00
13	50.00	
14	37.00	25.00
15	25.00	
16	34.00	37.00
17	12.00	8.00
18	-4.00	8.00
19		42.00
		Memory Growth *t* Test
		0.153741256

Students who received an NA score during the pre-test in orientation or placement did not receive a growth score, which is represented by a blank space. The students in the control group who were absent during the post-test also did not receive a growth score, which is represented by a blank space.

Table 8
Orientation Growth Comparison and t Test

Student	Experimental Orientation Growth	Control Orientation Growth
1	-22.00	6.00
2	18.00	
3	-4.00	8.00
4	-5.00	
5	11.00	5.00
6	0.00	0.00
7	6.00	0.00
8	10.00	19.00
9	8.00	
10	15.00	17.00
11	10.00	
12		0.00
13		
14	18.00	21.00
15	6.00	
16	-5.00	
17	-5.00	0.00
18	12.00	-7.00
19		0.00

Orientation Growth *t* Test
0.375588746

If a student received an NA score during the pre-test in orientation or placement, they did not receive a growth score, which is represented by a blank space. The students in the control group who were absent during the post-test also did not receive a growth score, which is represented by a blank space.

Table 9
Placement Growth Comparison and t Test

Student	Experimental Placement Growth	Control Placement Growth
1	15.00	16.00
2	5.00	
3	12.00	-28.00
4	-19.00	
5	31.00	17.00
6	9.00	7.00
7	13.00	-5.00
8	0.00	-16.00
9	-7.00	
10	0.00	13.00
11	-24.00	
12		7.00
13		
14	-35.00	-37.00
15	6.00	
16	0.00	
17	9.00	-15.00
18	-17.00	16.00
19		-13.00

Placement Growth *t* Test
0.329390925

Students who received an NA score during the pre-test in orientation or placement did not receive a growth score, which is represented by a blank space. The students in the control group who were absent during the post-test also did not receive a growth score, which is represented by a blank space.

Table 10
Total Growth Comparison and t Test

Student	Experimental Total Growth	Control Total Growth
1	7.33	7.33
2	17.33	
3	6.67	-9.33
4	-5.33	
5	18.33	6.00
6	7.00	16.33
7	9.00	-1.67
8	11.67	-1.67
9	-5.33	
10	5.00	13.00
11	6.67	
12	58.00	9.33
13	50.00	
14	6.67	3.00
15	12.33	
16	9.67	28.00
17	5.33	-2.33
18	-3.00	5.67
19		9.67

Total Growth *t* Test
0.12053847

Students who received an NA score during the pre-test in orientation or placement did not receive a growth score, which is represented by a blank space. The students in the control group who were absent during the post-test also did not receive a growth score, which is represented by a blank space.

Since the *t* tests were all above 0.05, Tables 7, 8, 9, and 10 show no significant growth in the areas of memory, orientation, placement, and total growth between the experimental group and the control group.

Additionally, the growth scores for all of the tests were compared between the boys and the girls in both groups. The only section of the assessment that showed significance was placement. Those results are represented in Tables 11 and 12.

Table 11
Boys Placement Growth Percentages and t Test

Experimental Group		Control Group	
Student	**Placement Growth**	**Student**	**Placement Growth**
2	5.00	5	17.00
4	-19.00	6	7.00
6	9.00	7	-5.00
7	13.00	12	7.00
9	-7.00	14	-37.00
11	-24.00	18	16.00
14	-35.00		

Boys Placement Growth *t* Test
0.207748607

Table 12
Girls Placement Growth Percentages and t Test

Experimental Group		Control Group	
Student	**Placement Growth**	**Student**	**Placement Growth**
1	15.00	1	16.00
3	12.00	3	-28.00
5	31.00	8	-16.00
8	0.00	10	13.00
10	0.00	17	-15.00
15	6.00	19	-13.00
16	0.00		
17	9.00		
18	-17.00		

Girls Placement Growth *t* Test
0.073863628

The data show that the growth of the girls who sat on a ball improved in the area of placement more than both girls who did not sit on a ball and boys who did

and did not sit on a ball. This is shown by the girls' placement growth *t* test having a *p* value of less than 1.0.

Research Question Two

Research Question Two asks the following: Does the use of a stability ball as a chair improve the handwriting of a student over time? In order to answer this question, the researcher examined the average growth of the experimental group and the control group in the different areas of the handwriting assessment. These results are recorded in Table 13 below.

Table 13
Growth Average Percentages

	Memory	**Orientation**	**Placement**	**Total**
Experimental Group Average Growth	20.28	4.56	-0.13	12.07
Control Group Average Growth	13.23	5.75	-3.17	6.41

The overall total average growth for the experimental group was 5.66 percentage points higher than the control group, indicating that students in the experimental group grew at a faster rate than those in the control group. This is also true in the memory section of the assessment. The experimental group average growth was 7.25 percentage points higher than the control group showing that the students in the experimental group grew at a faster rate in the area of memory.

Discussion

Summary

The purpose of this study was to determine if using a stability ball instead of a classroom chair in a Kindergarten classroom would improve handwriting. Based on the literature, posture and sitting position have a strong impact on handwriting and one way to improve posture is by sitting on a ball chair. Therefore, the researcher wanted to see if there was evidence to support the use of a ball chair as a tool to improve handwriting. Two research questions were asked: Is there a difference in handwriting development among students who use a stability ball as a chair and those who do not use a stability ball as a chair? Does the use of a stability ball as a chair improve the handwriting of a student over time? In order to answer these questions, the researcher used an experimental group and a control group and compared the results of a pre- and post-test in three different areas of handwriting: memory, orientation, and placement. A handwriting proficiency tool was used as the pre- and post-test. The results were scored by an occupational therapist for consistency.

After the data were collected, growth scores were calculated and compared between the experimental and control group in the areas of memory, orientation, and placement. Total growth scores were also calculated. It was found that there was no significant difference overall between students who used balls chairs and students who did not use ball chairs. However, when boys' and girls' growth scores were compared, the researcher found that the girls who used ball chairs grew more in the area of placement than any other student.

Average growth scores of the experimental and the control groups were also compared, and it was found that the experimental group's growth was almost twice as much as the control group. There was also a seven percentage point difference in the area of memory growth.

Recommendations

Based on the given data, it may seem like there is no significant impact on handwriting when using a ball chai. However, when different components of the data were analyzed more closely, the data support that there is more overall growth for the students who used a ball chair than for those who did not. This suggests that using a ball chair could have a positive impact on handwriting when considering overall growth. Memory growth in the experimental group was also more than five percentage points higher than the control group and might suggest that being able to recall how to form a letter correctly is positively impacted by sitting on a ball chair.

When looking at the progress of girls and boys, it should be noted that the girls who sat on a ball had a moderate difference in the area of placement when compared to the boys who sat on ball chairs and the girls and boys who did not sit on ball chairs. This would suggest that girls might have a better outcome in handwriting if sitting on ball chairs.

After reviewing these differences, the research would suggest that the use of a ball chair in a Kindergarten classroom could have a positive impact on handwriting. While sitting on ball chairs for 12 weeks did not significantly improve handwriting in the experimental group, some areas did show noticeable growth.

Therefore, implementing ball chairs in a Kindergarten classroom could positively impact handwriting.

Limitations

While the researcher was careful when designing and conducting this action research, there were some factors that could have affected the outcomes. The experimental group and the control group were similar in many aspects, yet having two different teachers could have impacted how students learned and practiced handwriting. To have a better understanding and application of the findings, more research should be done in other Kindergarten classrooms.

Since the research was conducted using an elementary classroom, the collection of data was restricted to a 12-week period. In order to get a better understanding of growth, a longer time frame could have yielded more significant results.

During the post-test, a number of students from the control group were absent due to illness and therefore did not participate in the post-test. This means that the sample from the control group was smaller than intended. Having a larger sample size could have yielded better results.

The assessment tool used for the pre- and post-test limited this research to just the areas of memory, orientation and placement. Other tools may have yielded broader data in handwriting growth.

When considering future research on using ball chairs in a Kindergarten classroom, there are many different areas to consider. Researchers might consider using a larger sample size or more classrooms to have more data to compare. Also,

research could be done using an additional assessment tool to gain more understanding of the different areas of handwriting that could be impacted. Researchers might also consider exploring if using ball chairs impacts time-on-task behaviors and movement of students. Ball chairs have been used as a positive teaching tool in many classrooms, and more research may help teachers to understand how the balls may be beneficial in their classrooms.

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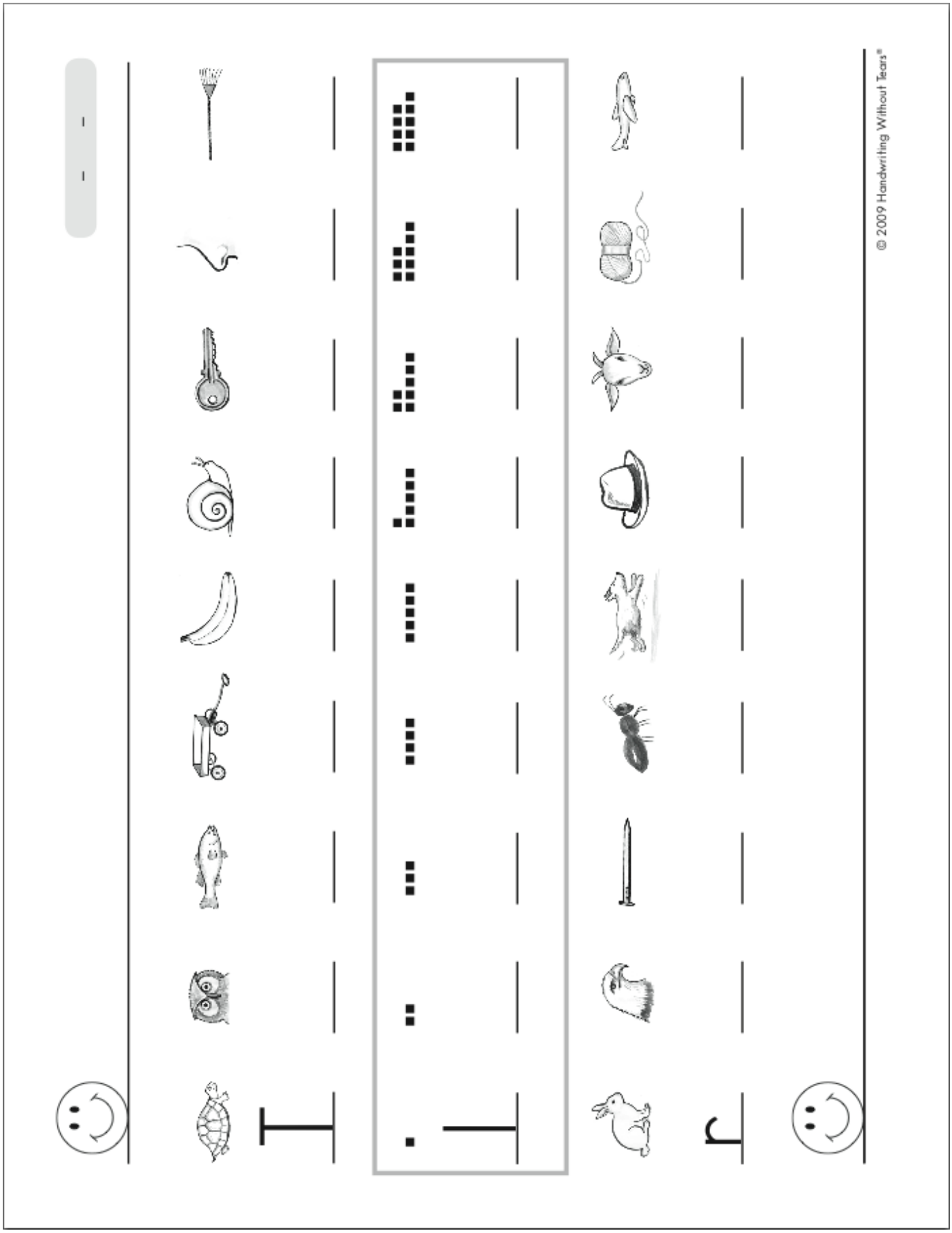
Appendix A
Handwriting Without Tears Screener of Handwriting Proficiency Student Test



Appendix B
Parent Letter Describing the Use of Ball Chairs in the Classroom

Dear Parents,

If you could improve your child's posture and focus in class while allowing the movement he/she needs, would you do it? You probably answered "yes." because these factors improve the learning environment. It is important to allow movement during the school day and because of that, I would like to put your child "on the ball," literally! I have completed the stability ball training through WittFitt LLC (explained below) and am ready to begin educating and preparing your child to sit on a stability ball instead of a standard chair. During the next few weeks, your child will learn about the benefits, safety, and use of the ball, as well as the importance of proper posture and classroom ergonomics. Students will be able to express why they should sit on a ball and help to create rules. Essentially, students "earn" the opportunity to sit on a ball.

Common Asked Questions
Who is WittFitt LLC?
They are a consulting company whose mission is to education children and adults about the importance of proper posture, active sitting and the strengthening of muscles used in daily activities, which are achieved by sitting while at school, work, home, and while exercising on a stability ball. As a comprehensive program, WittFitt LLC trains teachers and provide all of the necessary materials for both teachers and students. The program is customized to fit the needs of any classroom.

What kind of ball with the students be sitting on?
The stability balls are made of high quality plastic that is latex-free. It has small peg feet to provide some stability, keep it from rolling around the room, and for easy storage on the desktop. The ball is inflated to the designated size and custom fit to the child based on height and placement at their desk.

What are the benefits of sitting on the ball?
Enhances attention and concentration.
Improves learning through movement.
Promotes "active sitting" - with little to no disturbance.
Assists in improving posture.
Improves blood flow to all parts of the body, especially the brain.
Strengthens core (postural) & back muscle groups.
Improves balance and coordination.
Adjusts for customized fit to the individual.

Who uses the ball and why?
Today the ball is used by children and adults in the general population, as well as, athletic and personal trainers, physical therapists, coaches and other health

professionals. Its uses include: physical therapy, exercising, sitting, stretching, specified sports training and much more!

Is sitting on the ball disruptive in class?
The simple answer is, "no." There are several reasons this is true. First, teachers are trained on integrating the stability ball into the classroom, and well supported by WittFitt LLC staff throughout the process. Second, the students are required to follow a series of lessons for 2-3 weeks to learn about the stability balls and essentially "earn" their right to sit on a ball. In doing so, students are engaged and empowered with a sense of ownership and a greater understanding of lifelong wellness, and awareness of their body and the importance of taking care of it. In addition, by giving students a positive outlet to move, most previously seen behavioral issues are alleviated, thus improving the classroom environment. Once students are sitting on the ball on a daily basis, brief move and stretch breaks will be incorporated to allow students a mental and physical break which will in turn help them to focus and learn in a more effective manner.

Are there risks involved?
Sure, like anything else there are inherent risks. However, the positive return is far greater than any negative result of using the ball. Falling off the ball is one possible risk, though rare unless a student is acting inappropriately. From our experiences, it is more hazardous to have students rocking back on a regular classroom chair.

Sitting on the stability ball has many benefits that will not only help your child in school, but also in his/her daily activities, as well as, sports. If you have any questions or concerns, please feel free to email me. Also, please visit the WittFitt LLC website at www.wittfitt.com, as it will provide you with more in-depth information about Wittfitt. Many schools close by have already successfully implemented the use of stability balls into their classroom, and I believe that it can be done at SCCS as well! I am excited to help improve your child's learning experience through movement!

Blessings,
Megan Haan

Please fill out the attached slip and return to school.

Appendix C
Stability Ball Permission Slip

Stability Ball Permission Slip
In order for your child to sit on a stability ball, the following permission slip must be signed a returned to Mrs. Haan by September 13, 2012.

I, _____ (parent's printed name), have read this letter and give permission for _____(child's name) to sit on a stability ball in the classroom. I understand the inherent risks involved while sitting on a ball filled with air.

_____ _____

Parent Signature Date