USE OF THE STABILITY BALL AS A CHAIR IN THE CLASSROOM

By:

Lisa N. Witt

A Study
Submitted to the
Superintendent of the
Poudre School District

Tavelli Elementary School
Fort Collins, Colorado
June 2001

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Tavelli Elementary, 2001

The purpose of this study was to determine if the use of the stability ball for sitting, in an elementary classroom, was effective in improving one or more of the following: (a) flexibility/range of motion, (b), strength/stability, (c) balance, (d) posture, (e), squirminess, and (f) ability to stay on task, in male and female sixth-graders, ages 11 to 12 years.

Students were pre and post tested on seven motor tests and three classroom behavior tests. The seven motor tests included: Toe Touch, Trunk Rotation, Bent Knee Push-Ups, Tandem Heel-Toe Walking, Single Foot Balance, Pivot Prone, and Observable Posture. The three classroom behavior tests included: Squirminess, Time on Task, and Classroom Posture. After ten 20-minute stability ball sessions and 15 weeks of time on the ball, students were post tested.

The resulted indicated a positive improvement by students on 59 percent of the tests. Every student who participated in the study by sitting on the stability ball improved, as hypothesized, in one or more of the following: (a) flexibility/range of motion, (b) strength/stability, (C) balance, (d) posture, (e) squirminess, and (f) ability to stay on task.

Based upon the findings of the study, I recommend the implementation of the stability balls, instead of chairs, for the students in Mrs. Witt's classroom. I further recommend that the researcher conduct stability ball training at Tavelli Elementary, and in the Poudre School

District, for those teachers interested in introducing and using stability balls as chairs in their classroom.

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ACKNOWLEDGMENTS

I would like to acknowledge the many people who contributed to this study over the past school year. First, a thank you to Dr. Joe Hendrickson, who presented this opportunity to me and who let me "fly" with my idea. Also, I would like to thank Dr. Dan Lawler for granting me permission to conduct this study at Tavelli Elementary. Without these two individuals, this project would not have been possible. I also thank Dr. Don E. Unger, Mr. Gary Bamford, Mr. Jim Sachet and Mr. Bill Franzen for taking the time to consider this study.

Second, to Lori Nunnally OTR, Jennifer Gero, Cindy Curwick, Kimber Johnson, Noah Morton and Lauren Prele, who were a great help in conducting the pre and post testing, I thank them for their objectiveness and consistency.

Third, a special thanks is given to Joanne Posner-Mayer for taking the time to meet and talk about the balls. I thank her for sharing her vast resources and wealth of knowledge. Also, a thank you to Ball Dynamics International, Inc., a specifically to Rayna Gutru for donating the balls for the purpose of this study.

Last, to my husband Chad, who thought his days of working on a thesis were over three years ago. Chad initially sparked the idea of using stability balls in my classroom, and has supported me every step of the way. I thank him for the endless hours he put in helping me to revise this study. I could no have done it without him.

The eight months I have spent on this project were much more difficult than I had anticipated; however, this study is near to my heart, and was worth the time and effort. In the process, I learned a great deal about research, about my students, and about myself.

Lisa N. Witt

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CHAPTER I

INTRODUCTION

As an athletic and health-minded individual, this researcher has an interest in practical and applicable tools for the classroom, such as the stability ball. Though the stability ball was initially introduced in the professional setting of occupational and physical therapy, the ball has become mainstreamed into the fitness and personal health arenas. The stability ball has been shown to improve strength, range of motion, flexibility, proprioception, and posture (Reichley 1994).

This researcher was first exposed to the stability ball in the fitness setting for improved muscular strength, flexibility, and joint range of motion while training for triathlons and running races. In recent years, the ball has been introduced into both the home and work environment in replacement of chairs.

As a result of her positive experiences with the use of the ball, this researcher brought a ball into her home to be used instead of a chair, and to be used for stretching and exercising. Eventually, she began to use the ball as a chair in her classroom. During months of observing her students leaning back on chairs, fidgeting, and slouching, the researcher realized that the classroom chairs were not the ideal tool to promote a lifestyle of healthy posture.

It is clear to the researcher that the use of the stability ball in the classroom setting instead of a regular chair would greatly benefit children physically, which in turn would aid them cognitively. The balls for sitting would encourage proper posture and spinal health at a young age, which would set healthy habits for life.

Statement of the Problem

The focus of this research was to determine if the use of the stability ball would improve: (a) flexibility/range of motion, (b) strength and stability, (c) balance, (d) posture, (e) squirminess, and (f) ability to stay on task, in male and female sixth-graders, ages 11 to 12 years, in replacement of the classroom chair.

Need for the Study

This study is initiated on behalf of the elementary-aged children who typically sit in classroom chairs for roughly 25 hours each week, lending to poor posture (i.e., slouching, leaning over the desk, and leaning back on the chair), and constraint of movement. A primary reason for this study is to determine if the stability ball would encourage proper posture, while allowing natural body movement.

Delimitations

The following delimitations were established for this study:

1. Students were 12, "apparently healthy" (ACSM, 1995), volunteers, both male and female, between the ages of 11 and 12 years.
2. Only students with parental consent who had no preexisting medical conditions were able to participate.
3. All students followed the rules and code of conduct while sitting on the ball in order to maintain a safe and productive classroom. The rules were as follows: (a) no silliness on or near the ball, (b) no pushing, (c) no sharp objects in pockets while sitting on the ball, (d) no using sharp objects on or near the ball, (e) no sitting on the ball inappropriately. The students were clear that there were no

warnings. If they were unsafe or disruptive, they would be removed from the ball immediately.

4. Students were measured on seven motor tests and observed on three classroom behaviors before and after exposure to the ball.
5. Students were measured on seven motor tests: Toe Touch, Trunk Rotation, Bent Knee Push-ups, Tandem Heel-Toe Walking, Single Foot Standing Balance, Pivot Prone, and Observable Posture.
6. Students were observed and evaluated on three classroom behaviors: Squirminess, time-on-task, and classroom posture.
7. Students were sized to a stability ball based upon their height, and fit to the ball. To assure proper fitting, each student was observed on the ball and measurements were taken such that 90 degree angles were created at the hip, knees and ankles. Students were fitted to 45 centimeter or 55 centimeter balls.
8. Students were transitioned from chairs to the balls by progressively being exposed to more time on the ball within the classroom.
9. Students participated in ten 20-minute stability ball sessions (see Stability Ball Sessions, Appendix A) with the objectives of: (a) decreasing the novelty of the stability ball as a chair, (b) improving the comfort level of the students sitting on the ball, (c) developing greater static and dynamic balance while sitting on the stability ball, and (d) developing greater mobility while sitting on the ball.
10. Students sat on the balls for approximately five hours a day, five days a week, for 15 weeks.

11. All measurements were collected by the researcher or trained professionals.

Limitations

The study was limited by the following:

1. The sample size of the study (n = 12) is small.
2. The study was conducted in a classroom and not in a research laboratory.
3. The age range of the students, 11 to 12 years, is narrow: This may not be truly representative of the population who may use or benefit from the stability ball being studied.
4. Students were only exposed to the ball five hours a day, which may not be enough to counterbalance any chronic activities students participate in outside of the classroom.
5. External physical activities within the school environment were not controlled, thus possibly affecting pre and post-test measurements.
6. The 15 weeks of exposure occurred over 22 weeks due to holiday breaks in the school calendar.

Hypothesis

1. It is hypothesized that by having students sit on the stability ball instead of the classroom chairs their abilities in one or more of the following areas will improve: (a) flexibility/range of motion, (b) strength and stability, (c) balance, (d) posture, (e) squirminess, and (f) ability to stay on task.

Assumptions

1. Each student gave his or her best efforts when performing the pre and post-tests.
2. Each student, while being videotaped for classroom observations, demonstrated behavior consistent with that of a typical day.
3. Reach student participated in the ball sessions to the best of their ability to gain the most benefit from the exercises.

Definition of Terms

The following terms were defined in relation to the context of this study:

1. Stability Ball: (List of synonyms and/or brand names) Swiss ball, FitBALL®, Gymnic ball, Sit 'n' Gym, Physic ball, therapy ball, Gymnastic ball, Aerobic ball, and physiotherapy ball.
2. Time on Task: The amount of time spent, in a given time period, doing what was directed in a classroom setting.
3. Classroom Behaviors: These includes squirminess, time on task, and posture while sitting in the classroom.

CHAPTER II

REVIEW OF RELATED LITERATURE

In the 2nd century, A.D. Galen, a Greek philosopher and physician write about exercising with a ball and stated that the ball, "is able to give the most intense workout with the greatest relaxation." (Spalding, A., Kelly, L., Santo Pietro J., and Posner-Mayer, J. 1999) The benefits of using balls have been known for many centuries.

The stability ball, or Swiss ball as it was nicknamed by U.S. therapists, was first manufactured in Italy in 1963 by an Italian engineer, Acquilino Cosani, to be used as a toy. He created large yellow, orange and green vinyl balls and sold them all over Europe. At this same time, Mary Quinton, an innovative physical therapist in Switzerland, began to use the balls in her treatments with neurologically-impaired children. (Spalding, et al, 1999) Dr. Susan Klein-Vogelback, founding director of the Physical Therapy school in Basel, Switzerland was also introduced to the balls and was the first to use them for adults who suffered from orthopedic or other medical problems. Then, in the early 1970's, Maria Kucera, a Czech physical therapist and instructor, learned of the ball and wrote a book that includes 270 ball exercises. These women were clearly pioneers in the use of the ball as it expanded from being used simply as a toy to being used as a therapeutic tool.

Joanne Posner-Mayer, developer of FitBall USA and owner of Ball Dynamics International, Inc., (BDI), was an integral part of the process of introducing the ball to the United States. She began to send the balls to the United States in the early '70's due to their unavailability. Posner-Mayer, a graduate of the University of Colorado physical therapy, was a physical therapy in Switzerland for seven years. She was the only American to have the

opportunity to not only work with the ball in a variety of settings, but also learn from pioneering therapists, such as Mary Quinton. In 1979, Posner-Mayer, while working at the University of Colorado Hospital in Copenhagen, Denmark, began to lecture on the therapeutic uses of the Swiss ball. Through much of her experiences with the ball was for individuals who suffered one type of injury or another, she realized that it could be used for healthy people as well (Horizons, 1966). With this in mind, she returned to the United States in the 1980's. In 1991, due to an increasing demand for the balls, she founded BDI, which is now the nation's leading distributor of the ball. (Spalding, et al., 1999)

Since the introduction of the stability ball in the U.S., it has not only been used in the fitness industry, and in homes of people of all ages and abilities, it has also been the subject of research studies and classroom pilots. (Reichley, 1994)

In 1988, a Swiss therapist, Vlatka Zeller, was concerned with the rising number of teens who suffered back pain. She hypothesized that, "excessive sitting was responsible for the postural weakness and damage she saw in her patients. (Spalding, 1999) She, with the help of an elementary school principal and a doctor, replaced the traditional chairs in the elementary school classroom with balls. This lead to a "large scale test in Switzerland, which showed that children sitting on balls produced the following results: (a) hyperactive children became calmer and could focus for longer periods, (b) other children could generally concentrate better, (c) handwriting skills improved for children with poor penmanship, (d) children often showed a better understanding of the subject material, and (e) disorganized children developed a better sense of organization." Today, there are close to 5,000 Swiss classrooms sitting on balls. The ball has become prevalent not just in Switzerland, but also in Germany and Scandanavia, "to

promote improved posture and physical activity while sitting." According to Body, Trends, a health and fitness company, Enter office buildings and schools [in Europe] have been equipped with balls, not chairs, for sitting. ("Missel Swiss Ball," 2001)

In another study, in the United States, researchers used the stability ball as classroom chairs, with a specific group of students. Jefferson Public County Schools in Denver, Colorado, conducted this study to determine if the balls would be effective in the small classroom setting with developmentally delayed students. (Joseffy-Knapp, J., Scott, J., Wall, J., 1993) Students were required to: (a) have parental permission, (b) agree to follow the rules, (c) participate in eight weekly ball sessions and (d) complete both pre and post-tests. After completion of the ball sessions and the study, the stability ball replaced the chairs in the special education resource room. Results of the study concluded that the stability balls could successfully replace classroom chairs, as the students did demonstrate positive physical behaviors and motor skill changes. According to this study, results indicated an improvement in all of the areas that were tested. More specifically, in classroom behaviors (i.e., squirminess, time on task, time to get ready, fine motor control and classroom posture), there were negative changes. There was positive change in 67 percent of the items evaluated. Further, on the motor tests there was a positive change in 48 percent of the items evaluated. Finally, both the therapists and the adaptive physical educator who worked on this study felt that the students' sense of self-esteem and responsibility increased due to their experience with the ball.

Along with the studies have been conducted in schools, some individual teachers have introduced the ball into the classroom for sitting. In 1992, in Sonora, California, teacher Sue Cimino literally put her students on the ball. Cimino stated in an article that she has seen great

changes in her pupils' posture. Both Cimino and Marilyn Nishi, a physical therapist, believe that the purpose for using the balls for sitting is to teach kids at a young age to be aware of and improve their posture. Cimino also said that the balls are perfect for kids to bounce on while seated, as this takes into account the amount of energy kids possess. (Fuller, 1992)

According to David Witt, MPT, and Rett Talbot, MPT, in their article "Let's Get Our Kids on the Ball," postural education should be a part of elementary kids' lives. "Much like kids learn to brush their teeth at a young age to prevent tooth decay, we believe we should teach children at a young age how to prevent musculoskeletal decay." (Witt & Talbot, 1998) The authors designed a program which brought balls into a Delray Beach, Florida classroom to replace chairs. Long term, Witt and Talbot plan to study students who sit on the ball and measure their improvements over a period of time. In regard to short-term results, teachers reported an improvement in students' work habits and social conduct. Also, both teachers and kids alike enjoyed the balls for a variety of reasons and wanted to continue their use.

As stated earlier, the stability ball's original use was in the occupational and physical therapy settings. In Switzerland, the ball was used with babies who suffered neurological disorders, as well as for patients with orthopedic problem. At that time, the balls were also used in therapy schools all over Europe. (Reichley, 1994) The stability ball has not only been used in Europe, but also in therapeutic arenas in the United States. Occupational therapists use the stability ball 'as a tool for evaluating motor control and in assessing midline and equilibrium reactions. (Reichley, 1994) Additionally, they use the balls for treating people with neurological disorders including strokes or MS, for example.

Physical therapists use ball therapy with victims of traumatic brain injury (TBI). People

who suffer from TBI often have "devastating physical and cognitive disabilities." Using the stability ball helps the individual regain balance, endurance and coordination. (McQueen, 1995) The stability ball is also being used with athletes who have been injured or who have undergone surgery. One program focuses on strengthening the lumbar spine after surgery. (Dieter, 1996) The program utilizes a large physiotherapy (stability) ball with goals "to create an environment to stimulate: (a) balance, (b) proprioception and kinesthetic awareness, (c) dynamic and static control, (d) range of motion, strength and flexibility, (e) coordination, and (f) confidence." The patients follow five exercises used in the acute phase of lower back pain. Each exercise involves the use of the ball.

Other physical therapists use the stability ball in exercise classes with elderly patients who have arthritis, as well as with seriously overweight patients. Jan S. Gunter, Ph.D., PT, who directs the graduate program in physical therapy at Daemon College in Amherst, New York, states that the stability ball provides a fun, motivation tool for her patients. "Also, it's very dynamic, because in order to be successful in sitting on it and performing the exercises, you have to pull large numbers of functionally related muscle groups." Gunter also said that the use of the stability ball in her class improved her patients' physical function and "also improved their standing balance, and in addition to helping them improve their health and quality of life, they feel better about themselves." (Colan, 1995)

Just as the stability ball would be readily seen in therapy clinics, most fitness facilities or health clubs keep a variety of sizes and colors of stability balls as well. "Recently, the ball's potential in the fitness industry has become apparent, causing it to emerge from use in therapy alone to become a versatile, fun and effective tool in personal training sessions and classes."

("Using Fitball," 2001) Further, fitness professionals use stability balls with their clients for a variety of exercises. Health clubs also use the stability ball as part of group exercise classes, strength training, balance and core body training. According to Emily Listfield, editor-in-chief of Fitness Magazine, the balls are "definitely becoming bigger due to the new total-body approach to fitness." More and more, people are becoming aware of how the ball can strengthen the body's core, which in turn improves posture, and reduces the amount of injuries one might suffer due to weak muscles or imbalances. (Rubin, 2000) Further, in a pilot study by two physical therapy graduate students at Columbia University in New York, researchers wanted to determine if a low-intensity stability ball exercise program would improve: (a) maximal oxygen consumption ($V0_2$ Max), (b) resting heart rate, (c) resting systolic blood pressure, (d) spinal flexibility, and (e) functional reach. The 14 subjects, who were between the ages of 50 and 69, exercised while sitting on the stability ball for 40 to 50 minutes, three times a week, for a six-week duration of time. The researchers found that all of the subjects improved in the area of balance. (Adams 1994)

The stability ball, whether it is being used in a therapy or a fitness setting, purports many benefits for all who use it. When sitting on the stability ball, all of your muscles are working together to maintain your balance. "Consequently, just sitting on the ball helps stimulate muscle contractions in your neck, your buttocks and the muscles in your feet." (Reichley, 1994) Traditionally, the stability ball has been used for performing such exercises as: Sit-ups and push-ups; but its use has grown to squats, hamstring curl, tricep dips and more. Your muscles are challenged in a different way when you use it to perform exercises. "With traditional strength-training equipment, we generally work our muscles as movers," says Douglas Brooks, MS., an

exercise physiologist and co-developer of programming for Flexaball. "On the ball though, you work muscles in ways that they aren't accustomed by stabilizing the trunk and maintaining balance and posture." Brooks states that it makes sense to exercise with the ball because it actually mimics the stabilization that our body does all day. (Asp. 1998) Posner-Mayer would agree, and stated in a personal interview that when she teaches exercises on the ball, she focuses on those exercises that are considered functional. In other words, the balls need to be used for exercises that are similar to activities and movements we perform in our everyday life. (Posner-Mayer, 2001)

In addition to working your muscles in new and different ways and challenging your balance, the stability ball also provides benefits simply by sitting on it. The stability ball offers a rhythmical movement which causes a balance between tension and relaxation in the muscles. This in turn provides a feeling of well-being and a readiness for learning. Urs Illi, senior lecturer at the University of Basel in Switzerland, also states that we are all organisms who thrive on movement that "rigid seating" does not provide. The ball helps to address today's societal back pain problem. "Statistics from the medical community in industrialized countries who that 80 percent of the adult population suffers from back pain." (Spading, 1999) With the use of the stability ball for sitting, the body is allowed to move as it is naturally accustomed. The circular shape of the stability ball allows the following: (a) fluid transition of movements, (b) relaxed support for body parts, and (c) constant change of physiological sitting positions without the harmful pressure points. The stability ball provides dynamic mobile sitting which assures additional blood supply to all of the body's organs, especially the brain (Illi, 1994). "Poor posture not only causes wear and tear to the spine but it can significantly decrease lung capacity

and impair circulation to nerves, muscles and the brain" (Spalding, 1999). The ball promotes posture that a normal chair cannot provide. "The main problem with sitting in a NORMAL chair is that it does not encourage movement. We may be able to sit 'properly' for 10-12 minutes, but after that our muscles become tired and we fall into a bad posture, most often using a back rest. Something else to consider is the spine itself. When we sit, our spine should stay in the same alignment as when we stand. When we fall into bad posture, this alignment is severely distorted." ("Ball Chair," 2001) According to Peter Opsvik, designer of Stokke furniture for sitting, "Our bodies are not meant for sitting hour after hour, day in and day out, but for movement, for the active life of a Stone Age hunter or nomad. In actual fact, a greater part of the muscular and skeletal complaints in our present day industrial society is caused by too much sitting." (Opsvik, 2001) Opsvik further explains that our bodies "crave movement and variation." He notes that when we stand and sleep, we constantly move and shift to make our body more comfortable -- sitting is no different.

CHAPTER III

METHODOLOGY

The problem investigated in this study was to determine if the use of the stability ball instead of the classroom chair for sitting would improve any of the following: (a) flexibility and range of motion, (b) strength and stability, (c) balance, (d) posture, (e) squirminess, and (f) ability to stay on task. This chapter includes the following procedural steps: a) subject selection, b) instrumentation, and c) testing procedures.

Subject Selection

Students were 12 apparently health male and female volunteers, ages 11 to 12 years. Students were taken from one sixth-grade classroom. Parents consented to their child's participation in the study and stated that their child had no medical condition that would be interfered with using the stability ball or limit their participation in the study. (See, Permission Form, Appendix B)

Instrumentation

The equipment used to conduct the pre and post-tests consisted of the following:

1. Video camera
2. 12-inch high chair
3. 14-inch high chair
4. Three yard sticks
5. One padded mat
6. Masking tape
7. Stop watch

8. 10-foot long balance beam

Testing Procedures

All tests were concluded in Mrs. Witt's sixth grade classroom at Tavelli Elementary, in Fort Collins, Colorado. Prior to the pre and post-tests, students were asked to perform the tests to the best of their ability, and to wear the same shoes for each test to achieve consistency.

Observations

A video was set up in Mrs. Witt's room for the purpose of assessing the three classroom behaviors: Squirminess, Time on Task, and Classroom posture. The video camera was recording intermittently throughout the day, for a duration of three to four weeks before and after the study. Evaluators viewed the videotape and assessed students in the three areas aforementioned.

Toe Touch (TT)

This test was used to determine flexibility and range of motion of back and hamstring muscles. The students sat on a added met where a yardstick was placed at the 30-inch mark at the heels. With feet placed a hip-width apart, the students bent forward to touch their toes keeping their knees straight. The evaluator measured the distance from the end of the longest finger to the nearest one-half inch.

Trunk Rotation (TR)

This test was used to determine flexibility and range of motion of the shoulders and the hips. The students were appropriately seated on the bench facing forward (looking at a picture of a face). While continuing to look at the face and holding their arms abducted and at shoulder height, the students twisted their shoulders to one side. A yardstick was taped to the wall, and

was centered with zero at the students' spine. The measurement was taken where the students' fingertips touched the yardstick.

Bent Knee Push -Ups (PU)

This test was used to determine strength and stability by measuring upper body strength and shoulder stability. The push-up was administered with male subjects in the standard "up" position (hands shoulder-width apart, back straight, head up) and female subjects in the modified "knee push-up" (ankles crossed, knees bent at a 90-degree angle, back straight, hands shoulder-width apart, head up). When testing male subjects, the evaluator placed a fist on the floor beneath the subject's chest, and the subject lowered his/her body to the floor until the chest touched the tester's fist. The fist method is not used for female subjects, and no criteria are established for determining how much the torso must be lowered to count as a proper push-up. For both males and females, the subject's back was straight at all times and the subject pushed up to a straight-arm position. (ACSM, 1995) The maximum number of push-ups performed in 20 seconds consecutively without rest was counted as the score. Evaluators looked for shoulder stability by determining if the student was "hanging on their shoulders" with their back collapsed between their shoulders.

Tandem Heel-Toe Walking (TW)

This test was used to determine balance while walking. The students walked, heel to toe, across the ten-foot-long balance beam. The evaluator counted the number of consecutive steps which were heel to toe across the ten feet, and commented on balance.

Single Foot Standing Balance (with eyes open) (SFB)

This test was used to determine trunk stability and balance. The students placed their

hands on their hips and stood on one foot. The evaluator measured the length of time up, to 20 seconds for each leg respectively, while observing static balance and posture over the duration of time.

Pivot Prone (PP)

This test was to determine body posture by measuring trunk extension and shoulder retraction. The students assumed a prone position and lifted their head, shoulders and legs off the floor with their arms externally rotated and their shoulders retracted. They held for a minimum of 20 seconds. Evaluator noted the pattern of movement and the extent of the extension.

Comment on Observable Posture (OP)

This test was used to determine if there were any structural postural concerns and/or functional postural concerns which may be secondary to muscle tightness or tone. The evaluator commented on symmetry or asymmetry, and the presence of kyphosus, lordosis, scoliosis or rotational concerns.

CHAPTER IV

RESULTS AND DISCUSSION

The problem of this study was to determine if the stability ball instead of the classroom chair would improve (a) flexibility and range of motion, (b) strength and stability, (c) balance, (d) posture, (e) squirminess, and (f) ability to stay on task, in male and female sixth-graders, ages to 11 to 12 years, in replacement of the classroom chair. This chapter is organized into the following sections: (a) motor tests, (b) classroom behaviors, and (c) combination of motor tests and classroom behaviors.

Results

Motor Tests

Students' results in seven motor tests are presented in Table 1, and graphically shown in Figures 1 and 2.

In the TT test, seven students improved, four students decreased and one student showed no change.

In the TR test, three students improved, four students decreased, and five students showed no change.

In the PU test, ten students improved, two students decreased, and no students showed no change.

In the TW test, five students improved, one student decreased and six students showed no change.

In the SFB test, eight students improved, one student decreased and three students showed no change.

In the PP test, eleven students improved, no students decreased, and one student showed no change.

In the OP test, eight students improved, no students decreased and four students showed no change.

Every student improved in at least three of the seven tests. Two students improved in six tests. Three students improved in five tests. Four students improved in four tests. The average improvement shown on tests that students demonstrated was 4.33 tests of the seven measured. (See, Table 1)

Nine students decreased in one or more tests. This negative effect could be due in part to students experiencing muscle soreness after a physical education week of track and field testing.

The total possible sum resulting from all students exhibiting a positive change in all seven tests was 84. Fifty-two tests resulted in a positive change shown by students representing 62 percent of the total. Twenty tests resulted in no change shown by the students representing 24 percent of the total. Twelve tests resulted in a negative change shown by the students representing 14 percent of the possible. (See, Fig. 2)

Classroom Behaviors

Students' results in three classroom behaviors observed are presented in Table 2, and graphically shown in Figures 3 and 4.

On the SQ tests, seven students improved, no students decreased, and five students showed no change.

On the CP test, seven students improved, no students decreased and five students showed no change.

On the TOT test, five students improved, no students decreased and seven students showed no change.

Every student showed improvement or no change. Zero students showed a decline in skills from the pre to post-test. Three students improved on all three tests. Additionally, three students improved on two of the tests.

Table 1

Change in Motor Test Skills from Pre to Post Test

	Tests							Totals		
Student	TT	TR	PU	TW	SFB	PP	OP	+	n	-
A	1	-1	1	1	1	1	1	6	0	1
B	1	1	1	0	1	1	1	6	1	0
C	1	-1	1	0	1	1	0	4	2	1
D	-1	-1	1	0	1	1	1	4	1	2
E	0	0	4	4	4	4	4	5	2	0
F	1	0	1	0	1	1	0	4	3	0
G	-1	0	-1	1	0	1	1	3	2	2
H	-1	1	1	-1	1	1	1	5	1	1
I	-1	0	1	1	0	0	1	3	3	1
J	1	1	1	0	-1	1	1	5	1	1
K	1	-1	1	0	1	1	0	4	2	1
L	1	0	-1	1	0	1	0	3	3	1
Grand Totals								52	20	12
Averages								4.33	1.66	1.00

Note: The total possible sum of tests = 84 (12 students times seven tests)

Note: 1 = positive change, 0 = no change, -1 = negative change

Note: Totals: + = positive change, n = no change, - = negative change

The average improvement demonstrated by students was 1.58 tests of the three observation tests. (See, Table 2) With respect to posture and squirminess, seven of the 12 students improved, and five of the 12 students improved their ability to stay on task.

Figure 1

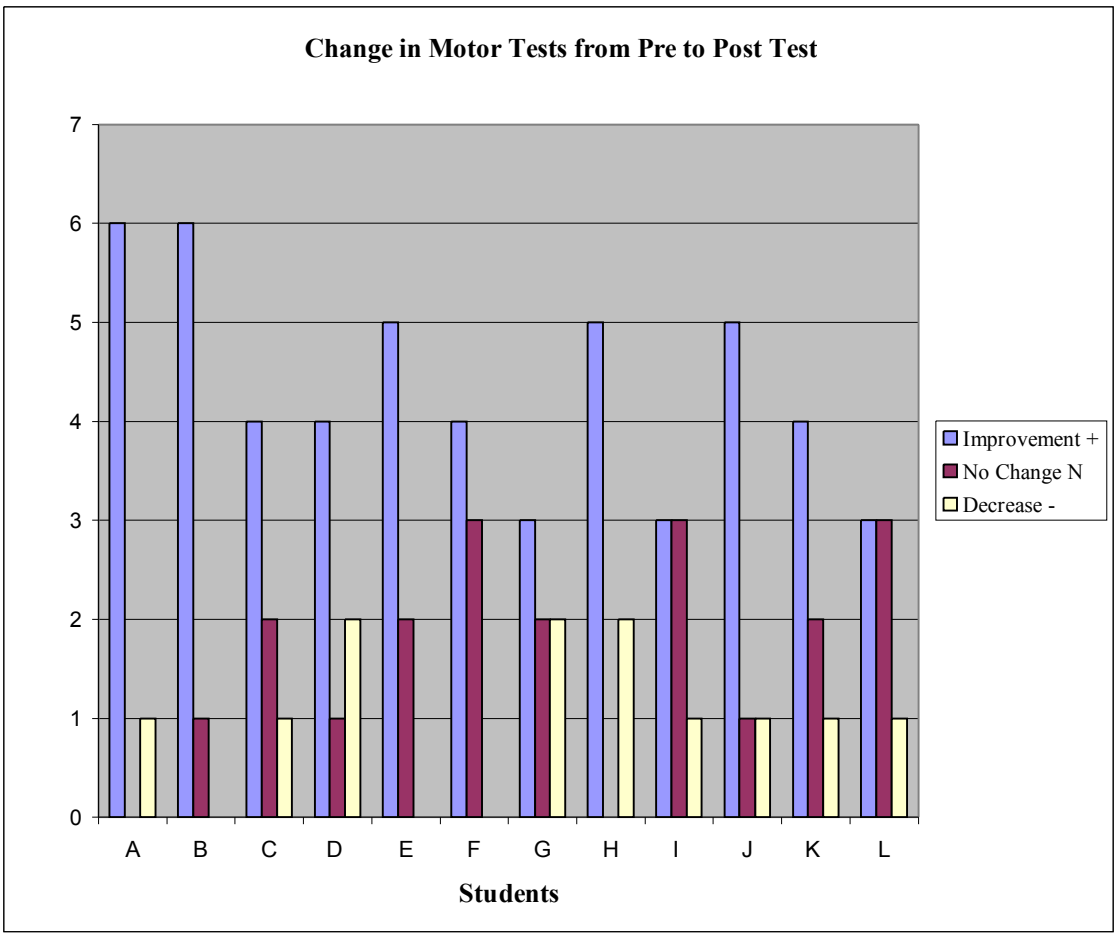
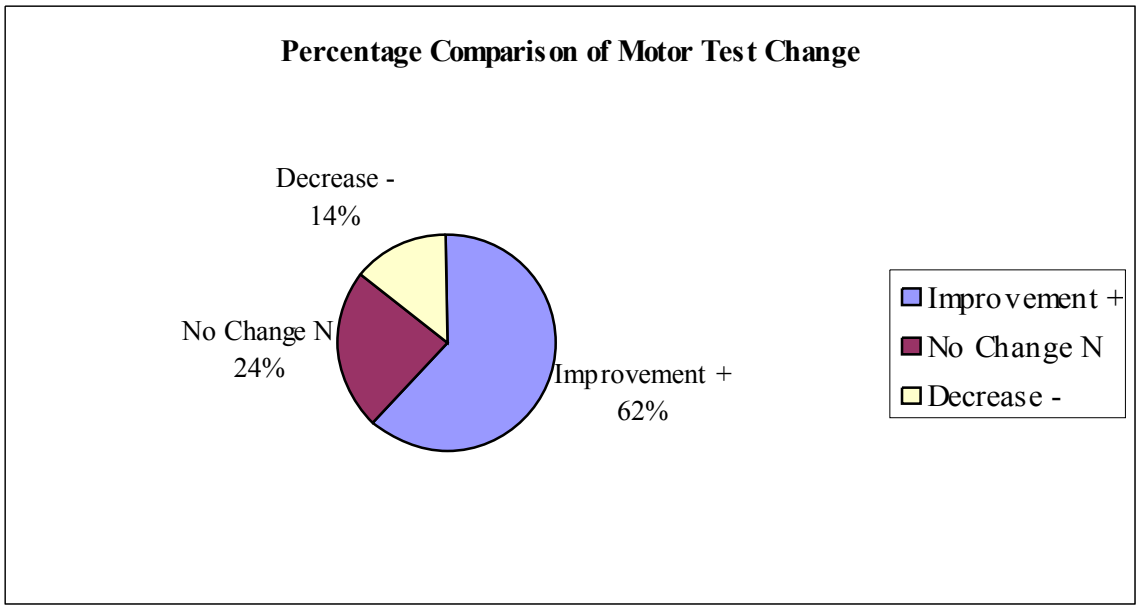


Figure 2



The total possible sum resulting from all students exhibiting a positive change in all three tests was 36. Nineteen tests resulted in a positive change shown by students representing 53 percent of the total. Seventeen tests resulted in no change shown by the students representing 47 percent of the total. No tests resulted in a negative change in classroom behavior. (See, Fig. 4)

Table 1

Change in Observed Classroom Behaviors from Pre to Post Test

	Tests			Totals		
Student	SQ	CP	TOT	+	n	-
A	0	1	0	1	2	0
B	1	0	1	2	1	0
C	1	0	1	2	1	0
D	1	1	1	3	0	0
E	4	4	4	3	0	0
F	0	0	0	0	3	0
G	1	1	0	2	1	0
H	1	1	1	3	0	0
I	0	1	0	1	2	0
J	2	1	0	1	2	0
K	1	0	0	1	2	0
L	0	0	0	0	3	0
Grand Totals				19	17	0
Averages				1.58	1.42	0.00

Note: The total possible sum of tests = 36 (12 students times seven tests)

Note: 1 = positive change, 0 = no change, -1 = negative change

Note: Totals: + = positive change, n = no change, - = negative change

Figure 3

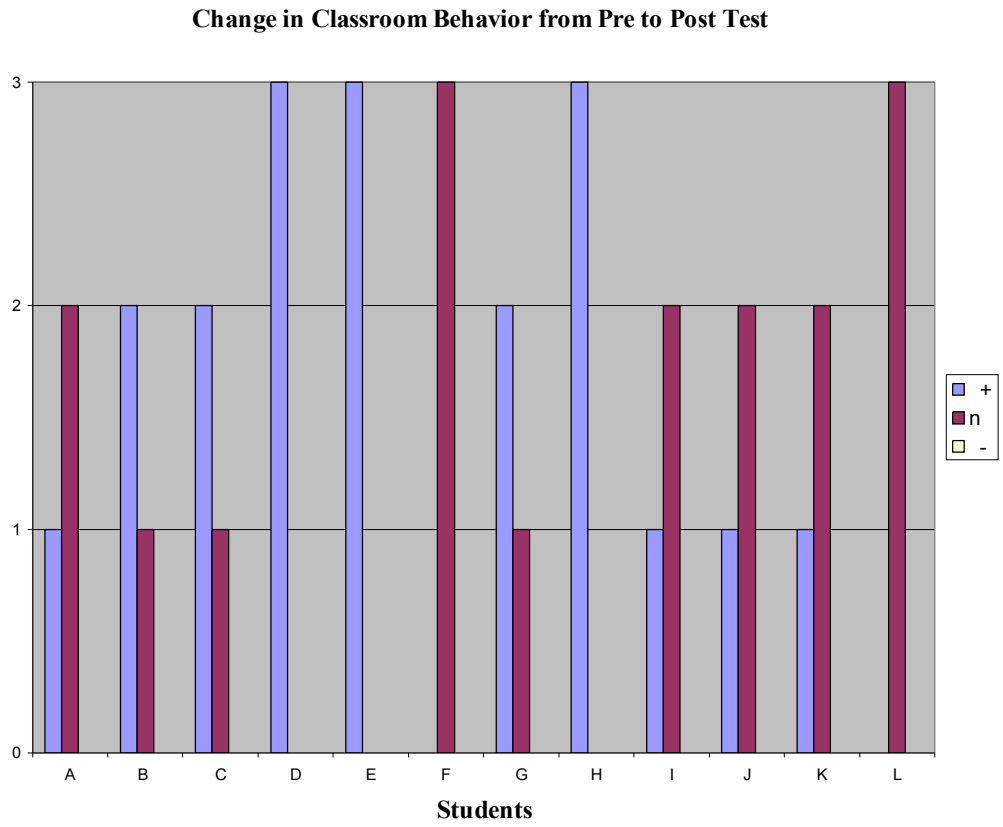
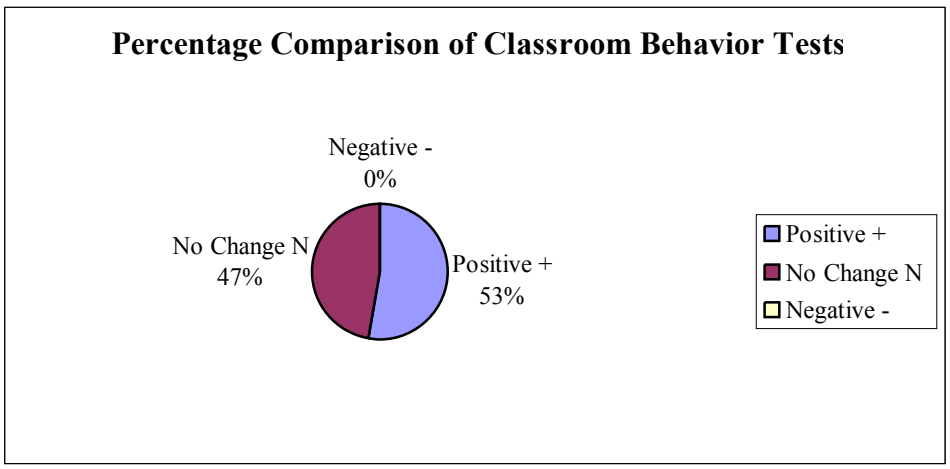


Figure 4



Motor Tests and Classroom Behavior

This section combines the results of the motor and the classroom behavior tests. The information is presented in Table 3, and graphically shown in Figures 5 and 6.

Twelve students completed ten total tests. The total possible sum resulting from all students exhibiting a positive change is 120. Seventy-one tests resulted in a positive change shown by students representing 59 percent of the total. Thirty-six tests resulted in no change shown by students represent 30 percent of the total. Thirteen tests resulted in negative change shown by students representing 11 percent of the total. (See, Fig. 6)

Three students improved on eight of ten tests, showing improvement in strength/stability, balance, posture, squirminess, and ability to stay on task. Two students improved on seven of the ten tests showing improvement in strength/stability, balance and posture. Two students improved on six of the ten tests showing improvement in flexibility/range of motion, strength/stability, and posture. The average positive improvement shown by students was on 5.9 of the ten tests.

Table 3

Total of Motor Tests and Classroom Behaviors

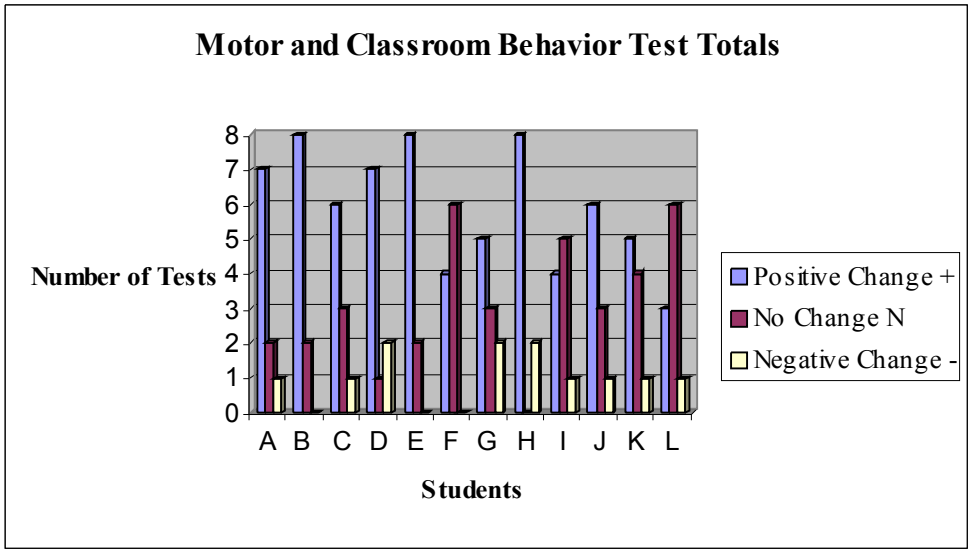
	Motor Tests			Observations			Totals		
Student	+	n	-	+	n	-	+	n	-
A	6	0	1	1	2	0	7	2	1
B	6	1	0	2	1	0	8	2	0
C	4	2	1	2	1	0	6	3	1
D	4	1	2	3	0	0	7	1	2
E	5	2	0	3	0	0	8	2	0
F	4	3	0	0	3	0	4	6	0
G	3	2	2	2	1	0	5	3	2
H	5	0	2	3	0	0	8	0	2
I	3	3	1	1	2	0	4	5	1
J	5	1	1	1	2	0	6	3	1
K	4	2	1	1	2	0	5	4	1
L	3	3	1	0	3	0	3	6	1
Grand Totals	52	20	12	19	17	.08	71	37	12
Averages	4.33	1.66	1.00	1.58	1.42	.08	5.91	3.08	1.00

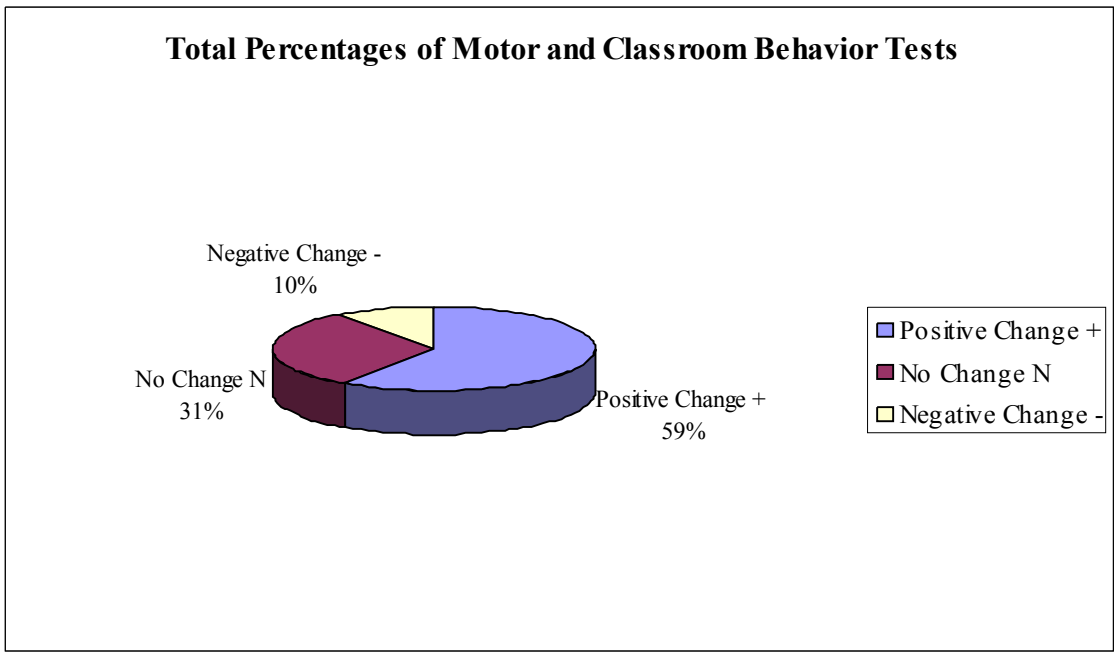
Note: The total possible sum of tests = 120 (12 students times ten tests)

Note: 1 = positive change, 0 = no change, -1 = negative change

Note: Totals: + = positive change, n = no change, - = negative change

Figure 5


Motor and Classroom Behavior Test Totals
Number of Tests
0
1
2
3
4
5
6
7
8
A B C D E F G H I J K L
Students
Positive Change +
No Change N
Negative Change -


Total Percentages of Motor and Classroom Behavior Tests
Negative Change -
10%
No Change N
31%
Positive Change +
59%
Positive Change +
No Change N
Negative Change -

Discussion

In this section the results of the present investigation are compared to information gleaned from previous studies and other sources on the subject of the stability ball.

It was hypothesized in this study that students would improve in one or more of the following areas: (a) flexibility/range of motion, (b) strength/stability, (c) balance, (d) posture, (e) squirminess, and (f) ability to stay on task. This reasoning was based on the fact that the stability ball activates many of the body's key muscle groups, especially core muscles. This causes the body to constantly balance, coordinate and support one's actions to remain on the stability ball. According to Illi (1994), "the circular shape of the stability ball allows the following: (a) fluid transition of movements, (b) relaxed support for body parts, (c) constant change in physiological sitting positions without the harmful pressure points."

Related sources Reichley (1994), Dieter (1996), and McQueen (1995), state the occurrence of improved balance with the use of the stability ball. Both Reichley (1994) and Dieter (1996) found that patients' range of motion and strength improved through the use of the stability ball program. According to Rubin (2000), Fuller (1992), (Witt & Talbot, 1998) and Illi (1994), posture was found to improve in stability ball users. Each of these sources supports the findings of the present study.

In this study, there was a positive change in 62 percent in the motor skills tested and a positive change of 53 percent in the classroom behaviors tested. In a similar study (Joseffy-Knapp, J., Scott, J., Wall, J. 1993), researchers found that there was a positive change of 48 percent and 67 percent, respectively. The motor skills assessed subjects' flexibility/range of motion, strength/stability, and balance, while the classroom behavior tests assess students'

classroom posture, squirminess, and ability to stay on task. Both studies concur with the hypothesis of this study.

Other studies and articles referenced also conclude that students who use the stability ball have an increased sense of self-esteem and readiness to learn. Also, the stability ball has been shown to be a useful motivational tool that is fun to use.

It is clear from this study, other studies, and related articles, that the use of the stability ball helps to improve students' motor skills and classroom behaviors. The balls are prevalent in schools and offices in Europe to promote good posture and spinal health, and have become popular in many schools in the United States as well.

Upon completion of data collection, the students who participated in the stability ball study were asked to complete an anonymous survey. The following are some of the comments compiled from these surveys. (See, Appendix C, Stability Ball Survey).

"Balls are awesome!"

"I feel that there are benefits such as getting stronger back muscles, i.e., when I slouch now it hurts and so I sit up because it feels much better."

"I think that everyone in Tavelli should sit on balls to help them improve their posture."

"Sitting on the ball helped me to learn because it has no back so you cannot slouch. My handwriting is better."

"It helps you concentrate on your posture."

"When I was not sitting on the ball I had backache when exercising, but ever since I've been on the ball I've had no back pain for six months. It helps me sit still and keeps me

comfortable.”

"I have better posture than I did before."

"The ball is a great chair to sit on."

Whether in a formal study or a casual observation, teachers report that students who sit on the ball exhibit improved posture, along with a variety of other positive changes. It is apparent then that schools, especially elementary schools whose population is young and impressionable, should be promoting proper posture. What better way to achieve this goal than to introduce an eye-catching, motivational tool such as the ball into the classroom. The authors of the book "Kids on the Ball" said it well when they stated, "When Swiss balls are used in the schools, you are taking the first step towards educating children about the importance of movement, exercise and spinal health." (Spalding, 1999) Education and schools exists not just to teach information, but to model and instill good habits that will last a lifetime.

CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS AND IMPLEMENTATIONS

Summary

The problem of this study was to determine if the stability ball instead of the classroom chair would improve (a) flexibility/range of motion, (b) strength and stability, (c) balance, (d) posture, (e) squirminess, and (f) ability to stay on task.

The subjects of this study were 12 male and female sixth-graders who were enrolled in Mrs. Witt's class at Tavelli Elementary in Fort Collins, Colorado. The students were ages 11 to 12 years old. Each student was required to have parental conset and agree to follow the rules and code of conduct. The data for this study were collected from November 2000 to April 2001.

Findings

The analysis of the data revealed the following significant findings:

Motor Tests

Every student improved in at least three of the seven tests. Two students improved in six tests. Three students improved in five tests. Four students improved in four tests. The average improvement shown on tests that students demonstrated was 4.33 tests of the seven measured. (See, Table 1)

The total possible sum resulting from all the students exhibiting a positive change in all seven tests was 84 (12 students times seven tests). Fifty-two tests resulting in a positive change shown by students is representative of 62 percent of the total sum. Twenty tests resulting in no change shown by the students is representative of 24 percent of the total sum. Twelve tests

resulting in a negative change shown by the students is representative of 14 percent of the possible. (See, Figure 2)

Classroom Behaviors

Every student showed improvement or no change. Zero students showed a decline in skills from the pre to the post-test. Three students improved on all three tests. Additionally, three students improved on two of the tests.

The average improvement demonstrated by students was 1.58 tests of the three observations. (See, Table 2) With respect to posture and Squirminess, seven of the 12 students improved. Five of the 12 students improved their ability to stay on task.

The total possible sum resulting from all students exhibiting a positive change in all three tests was 36. Nineteen tests resulted in a positive change shown by students representing 53 percent of the total. Seventeen tests resulted in no change shown by the students represent 47 percent of the total. No tests demonstrated a negative change in classroom behavior. (See, Fig. 4)

Motor Tests and Classroom Behaviors

Twelve students completed ten total tests. The total possible sum resulting form all students exhibiting a positive change is 120. Seventy-one tests resulted in a positive change shown by students represent 59 percent of the total. Thirty-six tests resulted in no change by students representing 30 percent of the total. Thirteen tests resulted in a negative change shown by students representing 11 percent of the total. (See, Fig. 6)

Conclusions

Results of this study demonstrated that students who sat on the stability ball improved in one or more of the following: (a) flexibility and range of motion, (b) strength and stability, (c) balance, (d) posture, (e) squirminess, and (f) ability to stay on task. Sitting on the ball has benefits for students in the classroom setting.

Implementations

1. Based upon the findings of this study, I recommend the implementation of the stability balls instead of chairs for the students in Mrs. Witt's classroom. This would be contingent upon parental permission and student willingness. Students would be educated on spinal health, proper posture, basic body mechanics, and ball benefits and uses. The balls would be purchased from Ball Dynamics International, Inc., at a cost of $13.95-23.95 per stability ball, depending on size and style of stability balls respectively. No shipping and handling would be charged. Ball Dynamics would agree to extent a 10 percent discount on the purchase of the stability balls if a bulk order is placed. The balls would be paid for by any one, or a combination of, the following sources: (a) Mrs. Witt's classroom budget, and/or (n) Tavelli's parent Parent Teacher Organization (PTO).
2. I further recommend, as the researcher, that I conduct stability ball lessons/sessions at Tavelli Elementary for those teachers interested in introducing and using stability balls as chairs in their classroom.
3. It is also recommended that after a one-year trial time period of using balls at

Tavelli Elementary, the researcher implement staff development training to other teachers and administrations of the Poudre School District regarding how to use the stability ball as a chair in the classroom.

Appendix A

Stability Ball Sessions

Stability Ball Sessions

These movement sessions have been omitted from this version of the study. The sessions are now part of the WittFitt School Program.

Appendix B

Permission for Participation in the Stability Ball Study

PERMISSION FOR PARTICIPATION IN STABILITY BALL STUDY

Your permission is requested for your child to participate in a small group study on the use of the stability ball for sitting in the primary classroom, in this case, Mrs. Witt's classroom. This will include pre and post-assessments and videotaping. It will also include movement sessions during WittFitt to help your child become comfortable using the stability ball as a chair. There is no cost for participation in this study. The balls have been donated to our 6th grade classroom for the purpose of this study by Ball Dynamics, International Longmont, Colorado.

By consenting, I am giving Poudre School Public Schools, Fort Collins, Colorado; Lisa Witt, 6th grade teacher; and Lori Nunnally, registered occupational therapist, permission to perform pre and post-testing and to videotape for observational purposes. I am giving consent for my child to sit on the stability ball instead of the regular classroom chair, and to perform directed exercises using the stability ball. Anonymity of participants will be maintained. Statistical data will be shared for educational purposes only.

Also, by consenting, I am releasing the above-named parties from any liability associated with my child's participation in the above-referenced study.

I (do / do not) give my consent for my child to participate in this study.

Student's name [print]: _____

Parent/Guardian name [print]: _____

Signature of Parent/Guardian: _____

Date: _____

Appendix C

Stability Ball Survey

Stability Ball Survey

Please answer the following questions honestly:

1. Do you feel that there are any **benefits** to sitting the ball?

2. Do you feel that there are any **negatives** to sitting on the ball?

3. Did sitting on the ball distract you from learning or help you to learn?

4. Should students have a choice of what they want to sit on in the classroom (i.e., ball or chair)?

* Other comments or suggestions:

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