5-15-2000

Brain Gym and its effect on the reading comprehension of third grade students with learning disabilities

Stacey P. Bundens
Rowan University

BRAIN GYM AND ITS EFFECT ON THE READING COMPREHENSION OF THIRD GRADE STUDENTS WITH LEARNING DISABILITIES

by
Stacey P. Bundens

Submitted in partial fulfillment of the requirements of the
Master of Arts Degree
of
The Graduate School
at
Rowan University
May 12, 2000

Approved by_____
Professor

Date Approved 5/12/00

ABSTRACT

Stacey Bundens

Brain Gym and its Effect on the Reading Comprehension

of Third Grade Students with Learning Disabilities

2000

Dr. S. Jay Kuder

Master of Arts Degree

The purpose of this study is to research the effects of the Edu-K/Brain Gym program on the reading abilities of learning disabled students. Fourteen students who had been diagnosed as learning disabled and enrolled in a self-contained third grade classroom participated in this study. The experimental group received fourteen days of treatment twice a day for ten minutes. The control group received no treatment. Pre- and post-test measures on the Woodcock Reading Mastery Test were compared to determine the progress of the students.

The data shows that the experimental group made only slight gains in the area of Word Comprehension. Both groups regressed in the area of Passage Comprehension as well as on the Reading Comprehension cluster.

Overall, the results of this study indicate that the Edu-K/Brain Gym program had little effect on the reading abilities of third grade learning disabled students.

MINI-ABSTRACT

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Dedication

This thesis is dedicated to the late James G. Atkinson

I learned from your example…

Aim for a goal and start on your way,
it may take a year, or only a day.
Travel slowly and watch for mistakes-
don't worry about the time it takes.
The path may be rough and mostly uphill;
but you'll get to the top by using your will.

Acknowledgements

I would like to thank the following people for the part they played in the completion of this master's thesis:

- To my family for their support and continual encouragement in the endeavors I undertake

- To Susan McGrath and Flavia Marella for their patience and assistance in the gathering of data

- To Clara Lindley for the use of her testing materials and sharing of her knowledge

- To the students at Radix Elementary School, Room 142 for their cooperation and participation in this study

- To Dr. S. Jay Kuder for his support in the writing of this thesis

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Chapter 1

Introduction

The US Department of Education (1995) has reported that more than 4% of all school-aged children receive services for learning disabilities. Many of these students are placed in self-contained classrooms and labeled learning disabled. Some are placed on Ritalin or other types of medication to help control their disability. One alternative to medication is the use of sensorimotor training. Sensorimotor activities have been researched and practiced with special students for many years. A well known researcher in the field of sensorimotor integration, A. Jean Ayres states, "Efforts to unravel the exact nature of learning disorders associated with minimal brain dysfunction have led to associating learning problems with deficits in sensory, perceptual and motor functions." (1969) One such sensorimotor program that has been gaining national attention is Educational Kinesthetics.

Educational Kinesthetics teaches movements of the body that can improve brain function. It is a noninvasive, drug free way of changing learning blocks into learning bridges (www.ebg-alternative.com/ritalin.htm). Dr. Paul E. Dennison, Ph.D., a learning specialist from California developed Educational Kinesthetics. One application of Edu-K is Brain Gym. The Brain Gym Program incorporates various techniques designed to enhance learning processes. It uses exercises that may help learning disabled students learn more effectively. Some of these exercises include crossing the midline, lengthening activities, energy exercises and deepening attitudes. Crossing the midline has been found

to strengthen reading and writing abilities. Lengthening activities help students learn to express stored knowledge, particularly when they are under stressful conditions. Energy exercises and deepening attitudes promote a flow of energy throughout the body. This energy helps the student release stress and fatigue enabling them to respond better to the learning process.

The philosophy behind the Edu-K program centers on whole-brain learning. Edu-K helps the two hemispheres of the brain work together simultaneously. Specific movements connect the right and left hemispheres in an integration process. The Edu-K program instructs the brain to activate all its functions completely.

Purpose

The purpose of this study is to research the effects of the Edu-K/Brain Gym program on the reading abilities of learning disabled students.

Hypotheses

1. Sensorimotor training; specifically the Brain Gym program will improve the motor skills of third grade learning disabled students.
2. Sensorimotor training; specifically the Brain Gym program will increase the reading comprehension abilities of third grade learning disabled students.

Definitions of Terms

Brain Gym- A series of specifically perceived movements which activate brain and body for specific skills of learning.

Cross crawl - Any contra-lateral movement whereby one side of the body moves in coordination with the other side, requiring bi-hemispheric brain activation.

Dennison Laterality Repatterning (DLR) - A movement experience which gives the individual permission to move without tension and to think without stress.

Edu-Kinesthetics (Edu-K)- The application of kinesthetics (movement) to the study of right brain, left brain, and body integration for purposes of eliminating stress and maximizing full learning potential.

Educational kinesiology- The study of the musculature system of the body and its relationship to whole brain learning.

integration - The lifelong process of realizing one's physical, mental, and spiritual potential, the first step being the simultaneous activation of both cerebral hemispheres.

laterality- The ability to coordinate one cerebral hemisphere of the brain with the other, especially in the midfield.

learning - Changed behavior.

learning disability - A disorder in one or more of the basic psychological processes involved in understanding or in using spoken or written language, which may manifest itself in an imperfect ability to listen, think, speak, read, write, spell or to do mathematical equations.

midfield - The area where one visual and hemispheric field overlaps the other for integrated learning.

midline - The line which separates one visual field and hemispheric awareness from the other when there is incomplete integration.

sensorimotor therapy- Therapy designed to improve the relationship between reflex actions and voluntary physical movements concerned with posture and locomotion.

simultaneous processing - The ability to access both cerebral hemispheres at the same time, maximizing hemispheric integration and reducing stressful learning.

Value of the Study

If the Brain Gym Program is found to be successful it could mean that educators have a noninvasive, drug-free method for helping students with learning difficulties. The program is fun, easy to utilize and can effortlessly be incorporated into a daily schedule. Training is readily available for educators as well as parents.

The results of this study could be beneficial in determining if Brain Gym should become part of the curriculum in elementary schools.

Chapter Two will define sensorimotor training and review various studies that have been conducted to determine if sensorimotor training is beneficial to children, and its effect on the reading comprehension abilities of learning disabled children. The Brain Gym Program will also be introduced and the relevant literature pertaining to the program reviewed.

Chapter Three will describe the students involved in the study, the tests that will be administered, the procedures that will be followed and the results that were determined.

Chapter 2

Literature Review

This review of the literature will consist of the following: an overview of sensorimotor training and the various techniques used; a review of the literature concerning sensorimotor training; a description of the Brain Gym program; and a review of the literature pertaining to the Brain Gym program and it's use with learning disabled students.

The term sensorimotor is used to refer to a class of intervention theories that emphasize the role of active experience-based learning. Experience-based learning began with Piaget's (1952) concept that children learn about their bodies and environment through personal experience. Piaget's teachings include a sensorimotor period of development. During this period infants learn through interaction with their environment. A child learns about his or her body through sensory feedback generated by body movement.

Sensorimotor approaches include the following types of training, sensory integration, perceptual-motor and neurodevelopmental.

A. Jean Ayres developed the sensory integration theory. She attempted to create a theory that would explain the connection between neural functioning, sensorimotor behavior and academic learning. In 1989 Ayres defined sensory integration as,

> The neurological process that organizes sensation from one's own body and from the environment and makes it possible to use the body effectively within the

> environment. The spatial and temporal aspects of inputs from different sensory modalities are interpreted, associated, and unified. Sensory integration is information processing...The brain must select, enhance, inhibit, compare, and associate the sensory information in a flexible, constantly changing pattern; in other words, the brain must integrate it.

Therapists have begun to use techniques that help students with sensory integrative problems. This type of sensorimotor therapy uses sensory stimulation and physical interaction to improve sensory integration, which in turn improves learning and behavior. This type of therapy is completely natural and is often found to be more effective than medication, mental analysis or behavior modification in helping the disabled brain self-correct.

A study performed by Pamela De Pauw, MS showed favorable results in the experimental group after a sensorimotor program was used with aphasic preschoolers (1978). The study investigated the value of a sensorimotor program to the sensory integration of aphasic students. This program was designed to enhance sensory integration using sensory stimulation through motor activities. The subjects were pre-tested and post-tested over a period of seven months using a portion of the Southern California Sensory Integration Test. Three groups of students were used in this investigation. One group was an experimental group while the remaining two groups were used as control groups. The experimental group participated in the sensorimotor program twenty minutes daily for seven months during the school year. One control group received remedial physical education and the other control group received neither program. Activities proceeded from simple to complex with the addition of new

activities and deletion of primary ones. Reinforcement and practice of basic activities was assured through the structure of activities and daily procedures. The sensorimotor program consisted of two main components, sensory stimulation and motor activities. Many of these activities were among those suggested for remediation of sensorimotor dysfunction as described by Ayres (1972 b).

The results of this study indicated that there was a considerable change between pre-test and post-test scores of the experimental and control groups. It also suggested that there was a significant difference between the scores of the two groups after the seven-month session. It seems that the aphasic students did benefit from the sensorimotor program intended to strengthen sensory integrative competence. Though inconclusive, there was also evidence that the program served to increase spontaneous speech both during and after the program. The author feels that though the study showed the program was a success there needs to be further research to evaluate the worth of a sensorimotor program for aphasic students.

Between 1965 and 1987, A. Jean Ayres has published numerous papers that claim the value of sensory integration therapy for learning disabled students. She states, "the end result of poor sensory integration is perceptual problems" and that, "one needs to process sensory input adequately for the brain to develop normally" (De Pauw, 1979). Other research has validated the improvement gained from sensory integration. "Sensory integration enhanced by a program of sensory stimulation and motor activities, can aid in the development of the more commonly known perceptual-motor activities" (Anderson 1971, Bell 1972, Heckelman 1969).

Kenneth Ottenbacher (1982) reviewed numerous studies examining the efficacy of sensory integration therapy. Forty-nine studies were located and from that group eight of the studies met the set criteria. A total of 317 subjects participated in the hypothesis tests used in those eight studies. The subjects ranged in age from 4 to 62 years. Within the group of 317 subjects, 89 were diagnosed as mentally retarded, 191 were diagnosed as learning disabled, 18 were diagnosed as aphasic and 19 were diagnosed as "at risk" for reading disorder. An analysis of the tests used in the eight studies showed that the subjects participating in the therapy performed significantly better than members of the control groups that did not receive the therapy.

The theories of perceptual-motor intervention are based on the work of Kephart (1960) and Cratty (1981). Maria Montessori (1912) and Piaget (1952) also contributed to these theories. These theorists felt that a child's perceptions of the environment were based on his or her motor experience. As a child grows older perceptual and cognitive processes become more important to learning. "Kephart (1971) hypothesized that by improving the underlying perceptual-motor deficit, learning would be improved."

Perceptual-motor training consists of specific training activities to improve motor behavior. For example, a child who has difficulties with balance would be given exercises to perform on a balance beam. This direct form of training would be expected to improve the child's balance. Newell Kephart proposed that motor development is the basis for all learning. He developed motor activities that he felt would enhance academic learning. Kephart suggests that learners must acquire "motor generalizations" in order to provide a basis for intellectual function (1971).

Joanna Sullivan, Ed.D. performed a study to determine the effects of Kephart's Perceptual-motor Training Program upon the reading performance of poor readers in a reading clinic population (1972). The students involved were of average and above average intelligence in grades 4-12. The study also included some students with visual defects. The study took place during a six week summer session. There were 41 subjects in both the experimental and control groups. They were homogeneous for age, grade, IQ, and reading performance.

The experimental group received three types of perceptual-motor training for thirty minutes daily for six weeks. The three types of exercises consisted of chalkboard, ocular pursuit and sensory-motor exercises. According to Kephart (1962) chalkboard training was meant to promote rhythmical movements and to familiarize the student with various movements on both sides of their body. The ocular pursuit training strives to improve control of eye movement and body control. Sensory-motor training was included to develop balance, laterality, and directionality. The results of this study showed that perceptual-motor training had no effect upon the reading comprehension of poor readers. However, the effects upon oral reading were close to significant. The exercises did not improve the reading abilities of the students with visual defects.

A study by Louis H. Falik, Ph.D. (1969) examined the effectiveness of including perceptual-motor training within the general kindergarten curriculum. Students scoring in the lower two-thirds on a readiness test were randomly assigned into control and experimental groups. The experimental group was assigned to a classroom using a perceptual-motor training program. The control group was assigned to an experienced teacher who had been judged competent in using a traditional approach. The teacher of

the experimental group periodically met with a committee to assist in curriculum development and planning. The standard kindergarten program was restructured using traditional activities in developmental sequence and including Kephart's Perceptual-motor Training Program. Gross motor development, eye-hand coordination and visualization patterns were all emphasized as well as some new activities. The control group spent the year in a traditional kindergarten classroom with the only addition being a semi-structured experience designed to equate in setting and activity to the experience of the experimental group. The children were tested at the end of the kindergarten year for reading readiness and perceptual-motor development. A year and one half later they were tested again for reading ability. The total number of children tested was 33, 16 of the original experimental group and 17 of the original control group. The results of this study show that there was no statistical difference between groups at the end of the kindergarten year on either the perceptual-motor test or the readiness test. When tested in the middle of second grade there was again found to be little or no difference between the experimental and control groups. Though the results of this study were not considered conclusive they seem to indicate that the role of perceptual-motor training with the average child is unwarranted.

Kavale and Mattson (1983) feel that the evidence on Perceptual-motor intervention has been based on informal, subjective evidence. In their Meta-Analysis of Perceptual-motor Training, "One Jumped Off the Balance Beam" they reviewed 180 studies that assessed the effectiveness of perceptual-motor training. The average study of those analyzed included students in grades 3.3 with an average age of 7.97 years and average IQ of 88.73. Treatment sessions averaged 19 weeks with 65 hours of training.

Their findings suggest that perceptual-motor training is not effective for exceptional children. In particular, the most popular programs designed by Frostig and Kephart had the least effect. The authors found no instance where perceptual-motor training was an effective intervention technique. They did find the quality of research methodology to be poor, resulting in almost half of the 180 studies being rated low in internal validity. However, the authors continue to conclude that perceptual-motor training is an ineffective program for children with disabilities citing that, "many weak studies can add up to a strong conclusion."

Neurodevelopmental Treatment is a sensorimotor approach developed by Berta and Karl Bobath. Neurodevelopmental treatment deals with the sensory aspect of movement. This movement-learning approach can be applied to clients with all types of disabilities. It is particularly appropriate for clients who have orthopedic or neuromuscular difficulties. This type of treatment considers both the neurological as well as the developmental aspects of learning. The goal of neurodevelopmental treatment is to give the client complete mobility during therapy and help him to develop control over abnormal patterns in order to gain more function. The therapist relays the potential of movement to the client so that it is felt and experienced completely. A second goal of NDT is to provide an extension into the client's daily activities and to improve the range of normal sensory experience.

There have been several studies that have examined the effectiveness of NDT. Woods and Kong investigated the outcome of NDT according to improvements in ambulation. Woods examined 478 children after treatment. He found that ineducable children with spastic cerebral palsy made little if any progress. Educable children with

spastic paraplegia or athetosis made the most progress, 91 of 118 children learned how to walk (Guess and Noonan, 1982).

Kong investigated 69 children that began NDT within the first year of life. Caregivers were trained to give the children daily interventions. After 1-4 years of treatment, 53 of the children with minimal CP developed a normal gait, 9 with mild CP learned to walk (2 with support) and of the 7 children who were moderately to severely affected one learned to walk (Guess and Noonan, 1982).

Wright and Nicholson used a control and comparison group to investigate NDT among 47 children diagnosed with CP. The children were divided into four groups according to their age. Children were then randomly assigned to one of three groups. Children in Group 1 received NDT for 12 months. Children in Group 2 received no NDT for 6 months then NDT for the next six months. The final group received no NDT for 12 months. The 12 month treatment group was found to make gains in head control and rolling skills. Developmental progress and a diminishing of primitive reflexes occurred for all subjects regardless of type or severity of CP (Guess and Noonan, 1982).

Carlsen (1975) compared NDT to a motor training approach that emphasized fine motor and self–help skills. Twenty children with CP ages 1-5 were matched for motor development and randomly assigned to a treatment condition. Training took place for one hour, two times per week for six weeks. The results of pre and posttests on the Bayley Scales of Infant Development and the Denver Developmental Screening Test suggested that NDT was more effective than the other treatment program (Guess and Noonan, 1982).

Research studying the effectiveness of NDT has been inconclusive. Reports have

been favorable, stating that clients have made improvements using NDT. However, there is no conclusive evidence stating that NDT works. There is no assessment device for NDT that is standardized, reliable or well validated.

Paul Dennison Ph.D., an educational specialist developed Brain Gym over a period of twenty-five years. He actively investigated the significance of movement on the ability to learn. He realized that many learning-disabled children had missed important steps in their development stages. He created Brain Gym because he believes that these gaps in learning can be remedied.

Brain Gym has been described as an, "educational sensorimotor program". It incorporates distinct actions similar to those that children normally do during their first three years of life as they complete important developmental steps for coordination of eyes, ears, hands and the whole body. (Educational Kinesiology Foundation, 1998)

Khalsa and Sifft (1998) performed a study to determine the effects of Educational Kinesiology upon the static balance of learning disabled students. The study used sixty students ranging in age from seven to eleven years old. The students were matched for age and gender and assigned to one of three groups. Group 1, repatterned E-K students took part in a movement analysis program before beginning treatments. Group 2, the E-K movement group who received only the Educational Kinesiology Program or Group 3, the control group who received no Educational Kinesiology treatments at all. The two groups who received treatments performed the E-K exercises for periods of five minutes, two times a day, five days a week for six weeks. All students were pre- and posttested using the modified stork stand of Anheim and Sinclair (1979). After a period of six weeks, the results showed that the repatterned group showed greater improvement in

static balance than the E-K Movement group. The E-K movement group showed greater improvement than the control group. The facts of this study support the hypothesis that Educational Kinesiology is effective in improving the static balance of the learning disabled child.

Sifft and Khalsa (1989) performed a study to determine whether Educational Kinesiology movements and or Dennison Laterality Repatterning are significant to the response times of college students to a visual stimulus. A total of twenty subjects were assigned randomly to three groups. The first group was a control group, the second group was the "Brain Gym" group and the third was the repatterned "Brain Gym" group. All subjects received practice trials on a simple visual response time task as well as on a 4-choice task. The subjects were then given 30 trials on each task to ascertain the mean pretest scores. After completing the pretest, the control group sat calmly for a period of ten minutes. The movement group participated in five "Brain Gym" movements. The members of the repatterned group took part in Dennison's Laterality Repatterning before performing the same five Brain Gym movements. All the subjects were again tested to identify any variance in performance using 30 trials of each task. The results of this study indicate that the Edu-K groups showed more improvement in their response time on a four-choice task than the control group. The Edu-K plus repatterning group improved by double the amount of the Brain Gym only group.

In this study students will be using four types of Brain Gym movements: Midline Movements, Energy Exercises, Lengthening Activities and Deepening Attitude Postures. These movements help learners integrate sensory patterns. The activation of these sensory patterns enhances learning ability.

Midline Movements teach skills that are needed for left to right movement across the midline of the body. The development of these skills is necessary for crawling, walking and whole body coordination. The Midline Movements also promote the learning of developmental skills and enable a learner to build on the skills that have previously been established.

Lengthening Activities may appear similar to the stretching exercises used in the fitness field. However, in the Brain Gym Program these exercises serve a different purpose. The lengthening activities help create neural pathways. These pathways enable the student to connect prior knowledge with the ability to process and express that knowledge.

The Brain Gym Energy Exercises and Postures for Deepening Attitudes also help to reinforce neural pathways between the body and the brain. This allows for the flow of electromagnetic energy within the body. Electromagnetic currents help us to maintain our directionality as well as our awareness of where we are in space and in association to other objects in our surroundings.

The consistent use of Brain Gym exercises enhances all learning processes. The specific movements taught improve mind function by integrating the left and right hemispheres of the brain. The Brain Gym Program may help students who experience learning and behavioral difficulties learn in a more effective manner.

Chapter 3

Design of the Study

Description of the Sample

This study was conducted at Radix Elementary School in Williamstown, New Jersey. Williamstown is a suburban area located about 25 miles east of Philadelphia. It is 47.5 square miles with a population of approximately 29,000. There are six schools in Williamstown, four elementary schools, a middle school and a high school.

Radix is the largest of the four elementary schools and serves approximately 900 students in preschool through fifth grade. 81% of those students are Caucasian, 15.9 % are of African American descent, 2.7 % of Hispanic descent and 0.4 % are of Asian descent.

Subjects of the Study

The subjects in this study were enrolled in a third grade self-contained classroom for students classified as learning disabled. The students range in age from eight to ten years. The students in the study consist of four females and ten males. The students were a heterogeneous group who exhibited a variety of learning disorders. These disorders include speech and language impairments, specific learning disabilities, a multiple handicap and a neurological impairment.

Speech and language impairments are defined as a communication disorder, such as stuttering, impaired articulation, a language impairment, or a voice impairment, that adversely affects a child's educational performance.

Specific learning disability is defined as follows:

(i) General. The term means a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in an imperfect ability to listen, think, speak, read, write, spell or do mathematical calculations, including conditions such as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia.

(ii) Disorders not included. The term does not include learning problems that are primarily the result of visual, hearing, or motor disabilities, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage.

Multiple disabilities means concomitant impairments (such as mental retardation-blindness, mental retardation-orthopedic impairment, etc.), the combination of which causes such severe educational needs that they cannot be accommodated in special education programs solely for one of the impairments. The term does not include deaf-blindness (P.W.D. Wright and P. Darr Wright, 1999).

Neurologically Impaired means a specific impairment or dysfunction of the nervous system, which adversely affects the education of a pupil. An evaluation by a physician trained in neurodevelopmental assessment is required (NJ Administrative Code, Title 6).

Subject # 1

The student is a nine-year-old female who is classified as having a specific learning disability. She receives speech therapy and self-esteem counseling.

Subject # 2

The student is an eight-year-old female who is classified as multiply disabled. She receives speech therapy and self-esteem counseling.

Subject # 3

The student is an eight-year-old female who is classified as communication impaired. She receives speech therapy.

Subject # 4

The student is a nine-year-old female who is classified as having a specific learning disability. She receives self-esteem counseling.

Subject # 5

The student is a ten-year-old male that is classified as having a specific learning disability.

Subject # 6

The student is a nine-year-old male that is classified as having a specific learning disability.

Subject # 7

The student is a nine-year-old male who is classified as having a speech and language impairment. He receives speech therapy and has been recommended for occupational therapy.

Subject # 8

The student is an eight-year-old male who is classified as having a specific learning disability. He has a history of ear infections. He has recently been released from the speech program.

Subject # 9

The subject is a nine-year-old male who is classified as having a specific learning disability. He receives speech services and has a severe articulation problem. He also has a great deal of difficulty with fine motor skills. He has been recommended for occupational therapy.

Subject # 10

The student is a ten-year-old male who is classified as having a specific learning disability.

Subject # 11

The student is a ten-year-old male who is classified as having a specific learning disability. He receives self-esteem therapy.

Subject # 12

The student is a ten-year-old male who is classified as having a specific learning disability. He was recently removed from a resource center program because of an inability to control his behavior.

Subject # 13

The student is a nine-year-old male who is classified as having a speech and language impairment. He receives speech services.

Subject # 14

The student is a ten-year-old male that is classified as neurologically impaired. He is mainstreamed for math.

Data Gathering Instruments

The Woodcock Johnson Reading Mastery Test Revised was used to measure the current level of reading ability for each child. This test is a comprehensive battery of tests measuring several aspects of reading ability. The subjects were administered the Reading Comprehension Cluster portion of the test. This includes, Word Comprehension and Passage Comprehension. The Word Comprehension test is comprised of the antonyms, synonyms and analogies subtests. The Woodcock was administered individually to each child over a period of fifteen days, from February 7 through February 22, 2000.

The Lincoln-Oseretsky Motor Development Scale was used to measure the motor ability of each child. This test involves a wide variety of motor skills including, eye-hand coordination, finger dexterity and gross motor skills of the hands, arms, legs and trunk. The scale is comprised of thirty-six subtests. However, due to time constraints only twenty of those subtests were administered to the subjects involved in this study. Of those twenty subtests two were eliminated halfway through the testing procedures because of difficulty in administration. The main goal of this scale is to measure motor development but it is used more generally to provide assessment of characteristics significant in understanding the whole child. The Lincoln-Oseretsky was administered individually to each child over a period of one week, from March 31, 2000 through April 6, 2000.

Procedure

The students in the study were separated into two groups. Group A was the control group while Group B was the experimental group. The dependent variable was the amount of growth shown by each student as measured by the Woodcock Reading Mastery Test and the Lincoln-Oseretsky Motor Development Scale. The independent variable was the Brain Gym Program. The students in Group B participated in specific sensorimotor activities. The Brain Gym sessions were held twice a day for 10 minutes, five days a week. The sessions consisted of three exercises in the morning and four in the afternoon.

Prior to participating in the brain gym exercises the students completed PACE. PACE is a routine that prepares the students for their Brain Gym exercises. To begin PACE the students drink one glass of water. Water is the medium that conducts electricity within the body and is best absorbed by the body when provided frequently and in small quantities. PACE also includes the following exercises; Brain Buttons, Cross Crawl, and Hook-Ups.

Brain Buttons are located directly over the carotid arteries and improve the communication between the two hemispheres of the brain. Students activate these Brain Buttons by massaging the tissue under the clavicle and on each side of the sternum. At the same time the other hand is kept over the belly button. This establishes the gravitational center of the body.

Cross Crawl is the second activity included in PACE. There are numerous ways to perform the Cross-Crawl. The most basic way is to sit on a chair and to touch each

elbow to it's opposite knee. Cross crawling reaches both sides of the brain at the same time and allows the student to cross the body's lateral midline.

Hook-Ups are the final activity included in PACE. To perform Hook-Ups the student crosses the left ankle over the right. The student then puts both arms out in front of her body and crosses the left wrist over the right. The student should then interlace their fingers and bring their hands up toward their chest. Eyes should be closed and the student should breathe deeply and relax for about sixty seconds. This exercise helps to balance the body and improve equilibrium. PACE should be used before beginning Brain Gym Activities or anytime the student desires greater balance.

The following exercises are just a portion of the complete Brain Gym Program. These exercises have been grouped together to provide a quick, simple and efficient program that will bring improved communication, enhanced self-esteem and balance to students in less than ten minutes twice a day. When all sessions have been completed students begin again with the first session.

Session 1-Morning-

The Owl- 3x each side

Thinking Cap-3x each side

Double Doodle- 30 seconds

Session 1-Afternoon-

Belly Breathing- 5 breaths

Space Buttons- 30 seconds each side

Calf Pump- 3x each side

The Energizer- 3x

Session 2-Morning

Earth Buttons-30 seconds each side

The Elephant- 5x each side

Session 2-Afternoon

Lazy 8s- 5x ea. Side, 5x together

Arm Activation- Do both sides

Footflex- 5x each side	The Rocker- 15 seconds
	Energy Yawn- 45 seconds
Session 3-Morning	**Session 3-Afternoon**
Grounder- 3x each side	Cross Crawl Sit-Ups- 12-15x
Balance Buttons- 30 seconds each side	Gravity Glider- 3x each side
Alphabet 8s	Neck Rolls- 20 seconds
	Positive Points- 45 seconds

Exercise Descriptions

The Owl- Grasp one shoulder while moving head slowly from one side to the other, keeping chin level. Breathe deeply throughout the motion. This activity releases neck tension and lengthens neck and shoulder muscles.

Thinking Cap- Fold ears back and massage beginning with the top of the ear and ending with the bottom lobe. This exercise helps to focus attention and improve listening comprehension.

Double Doodle- Draw with both hands moving together, mirroring each other. Refer to physical midline for directional reference. Using the directions, "Out, up, in and down" as students draw squares with both hands at the same time. Helps to establish direction and orientation in space relative to the body.

Belly Breathing- To begin, inhale through the nose and exhale in short puffs through pursed lips. Following that, continue to inhale and exhale through the nose. The hand should be placed over the abdomen rising and falling with each breath. This activity works as a reminder for the student to breathe during mental activity. It helps to increase the attention span and relax the central nervous system.

Space Buttons- Place pointer and middle fingers on upper lip. The other hand should rest on the back just above the tailbone. Breathe deeply throughout the exercise. This exercise helps to improve organizational skills and increase focusing abilities.

The Calf Pump- Lean forward pressing the back heel to the ground. Release and repeat. Breathe deeply throughout the exercise. This exercise lengthens the tendons in the feet and lower legs. It activates the brain for expressive speech and language activities as well as improving listening and reading comprehension.

The Energizer- Sit in a chair with the head resting on a table. Place hands on the table in front of the shoulders. Inhale and lift the head slowly beginning with the forehead, then the neck and lastly the upper back. Reverse the motion returning the forehead to the desk. This movement increases circulation to the frontal lobe, improving comprehension and rational thinking.

Earth Buttons- Place the fingertips of one hand on the upper lip. Place the other fingertips about six inches below the belly button. Hold these points for four to six complete breaths. Change hands in order to activate both the right and left sides of the brain. Helps the learner to organize their visual field and become better coordinated.

The Elephant- Bend your knees and lay your head on your shoulder. While imagining a figure eight on it's side point across the room and trace the eight with your arm and upper body. Switch arms and repeat exercise with the other side of the body. This exercise stimulates the inner ear for enhanced balance and integrates the brain for listening with both ears.

Footflex- Sit with the ankle resting on the other knee. Place the fingertips at each end of the calf muscle. Massage the muscles until they soften and relax. Flex and point

the foot while massaging the muscles. Repeat with the other leg. This exercise lengthens the tendons in the lower leg and relaxes the foot. This activity improves comprehension in listening and reading and activates creative writing ability.

Lazy 8s- Choose an area at eye level to be the center of the 8. Beginning with the left hand trace or draw the 8. The height and width of the 8 will vary but should involve the full extension of the arms. The head should move slightly while the eyes follow the outline of the 8. The crossing of the visual midline integrates both visual fields improving eye-muscle coordination.

The Rocker- While sitting on a soft surface lean back on the elbows and rock back and forth and in circles. This action massages the lower back and sacrum which stimulates nerves and helps the body to work more efficiently.

Arm Activation- Raise one arm and place it next to your ear. Push against the raised arm with the other hand. Push front, back, in and away while exhaling through the mouth. Repeat with the other arm and continue to breathe deeply throughout the exercise. This isometric exercise relaxes and lengthens the muscles of the chest and shoulders.

Energy Yawn- Pretend to yawn and massage the jaw muscles. Eyes should be closed and a yawning sound is made while massaging the muscles. This activity releases jaw tension and helps to balance the cranial bones. Oral reading and creative writing skills show improvement from this activity.

Grounder- Place feet about one leg length apart. Right foot should be pointed to the right and the left straight ahead. Bend the right knee and straighten the right leg. Breathe throughout the motion. Switch legs and continue to breathe. This activity

releases tension in the hip area and stabilizes the body. This exercise improves both long and short term memory.

Balance Buttons- Place fingertips at the base of the skull. The other hand should be placed over the belly button. Tuck in the chin and keep the head level for approximately 30 seconds. Repeat to the other side. This activity increases alertness and focus by stimulating the semicircular canals and reticular system.

Alphabet 8s- Clasp both hands together and using the lazy 8 form trace the lower case letters from *a* through *t* on either side of the 8 form. Letters *a,c,d,e,f,g,o,q,s* start on the curve of the 8 and move up to the left. Letters *b,h,i,j,k,l,m,n,p,r,t* start on the midline and move to the right. This activity helps students to discover the structural similarities between letters and helps to improve handwriting and fine-motor skills.

Cross Crawl Sit-ups- Perform basic sit-ups while touching the elbow to the opposite knee. Keep the neck relaxed and continue to breathe throughout the exercise. This exercise strengthens the abdominal muscles and makes the back stronger. It also helps to integrate the right and left brain hemispheres.

Gravity Glider- Sit in a chair and extend the legs in front of the body. Allow the upper body to fall forward from the base of the hips. Breathe out while reaching forward and breathe in while returning to an upright position. This exercise activates the brain for balance and coordination.

Neck Rolls- Allow the head to roll smoothly and slowly from side to side. Breathe deeply while performing this activity. Neck rolls help to relieve stress and relax the neck.

Positive Points- Use the fingertips to lightly touch the point above each eye. The points are located above the eyes, partway between the hairline and the eyebrows. While touching the points the student should concentrate on something he would like to remember. This activity helps to release mental blocks as well as improve test performance. (Dennison & Dennison, 1988)

Chapter 4

Analysis of the Data

The purpose of this study was to determine if students using the sensorimotor program, Brain Gym would show improvement in reading comprehension. Pretests were administered to all students using the Woodcock Reading Mastery Test Revised and the Lincoln-Oseretsky Motor Development Scale. After two weeks of Brain Gym training, students were post-tested. The results were analyzed within each category.

Lincoln-Oseretsky Scale of Motor Development

Table 1 reflects the pre- and post-treatment scores achieved on the Lincoln-Oseretsky Motor Development Scale. As a whole, the class improved an average of 8.0 points. Tables 2 and 3 reflect the scores of the experimental group and the control group separately. The experimental group averaged an improvement of 8.7 points while the control group improved by an average of 7.2 points. Most of the students in the experimental group showed a higher point gain than those in the control group. Subject number fourteen in the control group showed the most improvement out of all the students. He improved by twenty-one points. The significant increase in this subject's score raised the average of the control group by two points.

Table 4 reflects the percentile norms for males and females on the Lincoln-Oseretsky Motor Development Scale. Three students in the experimental group scored within the 98th percentile or higher. The lowest student in the experimental group scored within the 50th percentile. In the control group one student scored within the 96th

percentile and one within the 68th percentile. The remainder of the students in the control group scored in the 35th percentile or below.

Table 1

Lincoln –Oseretsky Motor Development Scale Pre- and Post Treatment Scores

Subject	Task 1	Task 2	**Task 3**	Task 4	Task 5	Task 6	Task 7	**Task 8**	Task 9	Task 10	**Task 11**	**Task 12**	Task 13	Task 14	Task 15	**Task 16**	Task 17	**Task 18**	Total	Gain
1 Pre	3	2	6	0	3	3	3	0	3	3	3	4	3	0	3	2	0	0	41	
1 Post	3	3	6	3	3	3	3	0	3	3	4	3	0	3	3	6	0	6	55	**+14**
2 Pre	3	3	6	3	3	3	0	0	3	0	3	0	3	3	0	0	0	0	33	
2 Post	3	3	6	3	3	3	3	0	3	0	1	4	3	3	0	0	0	6	44	**+11**
3 Pre	3	3	5	3	3	3	3	0	0	0	2	1	0	0	3	0	2	4	35	
3 Post	3	3	6	3	3	3	3	0	0	0	3	1	3	2	3	0	2	3	41	**+6**
4 Pre	0	2	6	3	3	3	3	0	3	0	3	1	0	0	0	0	0	0	27	
4 Post	2	2	6	3	3	3	3	1	3	0	1	1	0	0	0	0	0	0	28	**+1**
5 Pre	3	3	6	3	3	3	3	0	0	0	3	2	0	0	3	3	0	0	35	
5 Post	3	3	6	3	3	3	3	0	3	3	2	3	0	3	3	3	0	0	44	**+9**
6 Pre	2	0	5	3	3	3	0	0	3	0	3	0	0	0	3	3	0	0	28	
6 Post	3	0	2	3	3	3	3	0	3	0	0	1	3	0	3	3	0	0	30	**+2**
7 Pre	2	3	2	3	3	3	2	0	0	3	1	1	3	0	0	0	0	0	26	
7 Post	0	3	5	3	3	3	3	0	3	3	2	0	3	0	0	6	0	0	37	**+11**
8 Pre	3	0	6	3	3	0	3	1	0	3	3	3	0	0	3	3	0	0	34	
8 Post	3	2	6	3	3	2	3	0	0	3	2	5	3	0	3	3	1	0	42	**+8**
9 Pre	2	3	6	3	3	3	3	3	0	0	2	2	0	0	3	0	0	0	33	
9 Post	3	3	6	3	3	3	3	3	3	0	2	0	0	3	3	3	1	0	42	**+9**
10 Pre	3	3	5	3	3	3	3	2	0	3	4	1	3	0	3	0	0	3	42	
10 Post	3	3	6	3	3	3	3	0	0	3	4	1	3	3	3	3	1	0	45	**+3**
11 Pre	3	0	6	3	3	0	3	1	3	3	3	2	0	0	3	0	1	0	34	
11 Post	3	3	6	3	3	2	3	1	3	3	2	0	0	3	3	0	0	0	38	**+4**
12 Pre	3	3	6	3	3	3	3	0	0	0	3	2	0	0	3	3	0	0	35	
12 Post*																				
13 Pre	3	3	0	3	3	3	3	0	3	3	3	1	0	0	3	0	0	0	31	
13 Post	3	3	2	3	3	3	3	0	3	3	2	0	0	3	3	0	2	0	36	**+5**
14 Pre	0	0	3	0	3	3	0	0	0	3	1	1	3	0	0	0	0	0	17	
14 Post	3	3	5	3	3	3	2	0	3	3	4	0	3	0	0	3	0	0	38	**+21**
Average Gain																				**8.0**

*Student unable to be post-tested due to illness.

Table 2

Lincoln-Oseretsky Motor Development Scale Experimental Group Pre- and Post Treatment Scores

Subject	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6	Task 7	Task 8	Task 9	Task 10	Task 11	Task 12	Task 13	Task 14	Task 15	Task 16	Task 17	Task 18	**Total**	**Gain**
1 Pre	3	2	6	0	3	3	3	0	3	3	3	4	3	0	3	2	0	0	41	
1 Post	3	3	6	3	3	3	3	0	3	3	4	3	0	3	3	6	0	6	55	**+14**
2 Pre	3	3	6	3	3	3	0	0	3	0	3	0	3	3	0	0	0	0	33	
2 Post	3	3	6	3	3	3	3	0	3	0	1	4	3	3	0	0	0	6	44	**+11**
7 Pre	2	3	2	3	3	3	2	0	0	3	1	1	3	0	0	0	0	0	26	
7 Post	0	3	5	3	3	3	3	0	3	3	2	0	3	0	0	6	0	0	37	**+11**
8 Pre	3	0	6	3	3	0	3	1	0	3	3	3	0	0	3	3	0	0	34	
8 Post	3	2	6	3	3	2	3	0	0	3	2	5	3	0	3	3	1	0	42	**+8**
9 Pre	2	3	6	3	3	3	3	3	0	0	2	2	0	0	3	0	0	0	33	
9 Post	3	3	6	3	3	3	3	3	3	0	2	0	0	3	3	3	1	0	42	**+9**
10 Pre	3	3	5	3	3	3	3	2	0	3	4	1	3	0	3	0	0	3	42	
10 Post	3	3	6	3	3	3	3	0	0	3	4	1	3	3	3	3	1	0	45	**+3**
13 Pre	3	3	0	3	3	3	3	0	3	3	3	1	0	0	3	0	0	0	31	
13 Post	3	3	2	3	3	3	3	0	3	3	2	0	0	3	3	0	2	0	36	**+5**
Average Gain																				**8.7**

Table 3

Lincoln-Oseretsky Motor Development Scale Control Group Pre- and Post Treatment Scores

Subject	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6	Task 7	Task 8	Task 9	Task 10	Task 11	Task 12	Task 13	Task 14	Task 15	Task 16	Task 17	Task 18	**Total**	**Gain**
3 Pre	3	3	5	3	3	3	3	0	0	0	2	1	0	0	3	0	2	4	35	
3 Post	3	3	6	3	3	3	3	0	0	0	3	1	3	2	3	0	2	3	41	**+6**
4 Pre	0	2	6	3	3	3	3	0	3	0	3	1	0	0	0	0	0	0	27	
4 Post	2	2	6	3	3	3	3	1	3	0	1	1	0	0	0	0	0	0	28	**+1**
5 Pre	3	3	6	3	3	3	3	0	0	0	3	2	0	0	3	3	0	0	35	
5 Post	3	3	6	3	3	3	3	0	3	3	2	3	0	3	3	3	0	0	44	**+9**
6 Pre	2	0	5	3	3	3	0	0	3	0	3	0	0	0	3	3	0	0	28	
6 Post	3	0	2	3	3	3	3	0	3	0	0	1	3	0	3	3	0	0	30	**+2**
11 Pre	3	0	6	3	3	0	3	1	3	3	3	2	0	0	3	0	1	0	34	
11 Post	3	3	6	3	3	2	3	1	3	3	2	0	0	3	3	0	0	0	38	**+4**
12 Pre	3	3	6	3	3	3	3	0	0	0	3	2	0	0	3	3	0	0	35	
12 Post*																				
14 Pre	0	0	3	0	3	3	0	0	0	3	1	1	3	0	0	0	0	0	17	
14 Post	3	3	5	3	3	3	2	0	3	3	4	0	3	0	0	3	0	0	38	**+21**
Average Gain																				**7.2**

Table 4

Lincoln- Oseretsky Motor Development Scale
Recalculated Percentile Averages - Experimental Group

Subject	Experimental Pre-Test	Experimental Post-Test	Gains
1	78	100	22
2	69	100	31
7	8	78	70
8	75	98	23
9	34	82	48
10	58	73	15
13	24	50	26
Average	49	83	34

Table 5

Lincoln- Oseretsky Motor Development Scale
Recalculated Percentile Averages - Control Group

Subject	Control Pre-Test	Control Post-Test	Gains
3	79	96	17
4	11	13	2
5	30	68	38
6	13	20	7
11	19	35	16
12*			
14	0	35	35
Average	25	45	19

*Student unable to be post-tested due to illness.

Woodcock Reading Mastery Test Revised

The Woodcock Reading Mastery Test Revised was used to test the student's reading comprehension abilities. The test consisted of Word Comprehension, Passage Comprehension and a Reading Cluster Test. Table 5 reflects the grade equivalent scores for the Woodcock Reading Mastery Test Revised. The average gain for the whole class

in word comprehension was one month. The class regressed by an average of three months on the passage comprehension portion of the test. On the reading cluster test the class again regressed by an average of two months. Tables 6 and 7 show the results for the experimental group and the control groups separately. The passage comprehension and the reading cluster scores continue to regress for both the experimental and the control groups. The word comprehension scores improved by three months for the experimental group. The control group regressed in word comprehension by an average of one month.

Table 6

Woodcock Reading Mastery Test: Pre-Treatment and Post-Treatment Test Scores

Subjects	Word Comp. Pretest	Word Comp. Posttest	Gain	Passage Comp. Pretest	Passage Comp. Posttest	Gain	Reading Cluster Pretest	Reading Cluster Posttest	Gain
1	2.2	2.6	**0.4**	2.7	2.1	**-0.6**	2.4	2.4	**0.0**
2	2.1	2.5	**0.4**	1.9	2.4	**0.4**	2.0	2.4	**0.4**
3	2.2	2.9	**0.7**	2.2	2.3	**0.1**	2.2	2.6	**0.4**
4	2.7	2.3	**-0.4**	2.6	2.8	**0.2**	3.2	2.6	**-0.6**
5	2.7	2.5	**-0.2**	2.9	2.3	**-0.6**	3.1	2.4	**-0.7**
6	1.8	1.7	**-0.1**	1.9	2.0	**0.1**	1.9	1.9	**0.0**
7	3.3	3.1	**-0.2**	2.9	2.5	**-0.4**	3.1	2.8	**-0.3**
8	2.7	3.2	**0.5**	2.9	2.3	**-0.6**	2.8	2.7	**-0.1**
9	2.5	3.1	**0.6**	2.5	2.2	**-0.3**	2.2	2.6	**0.4**
10	3.2	3.2	**0.0**	3.3	2.5	**-0.8**	3.2	2.8	**-0.4**
11	3.2	2.9	**-0.3**	3.0	2.6	**-0.4**	3.1	2.8	**-0.3**
12	3.4	3.3	**-0.1**	3.5	3.0	**-0.5**	3.5	3.1	**-0.4**
13	2.9	3.2	**0.3**	2.7	2.1	**-0.6**	2.8	2.6	**-0.2**
14	2.7	2.5	**-0.2**	3.0	2.5	**-0.5**	2.9	2.4	**-0.5**
Average Gain			**0.1**			**-0.32**			**-0.16**

Table 7

Woodcock Reading Mastery Test: Experimental Group Pre- and Post-Treatment Scores

Subjects	Word Comp. Pretest	Word Comp. Posttest	Gain	Passage Comp. Pretest	Passage Comp. Posttest	Gain	Reading Cluster Pretest	Reading Cluster Posttest	Gain
1	2.2	2.6	**0.4**	2.7	2.1	**-0.6**	2.4	2.4	**0.0**
2	2.1	2.5	**0.4**	1.9	2.4	**0.4**	2.0	2.4	**+0.4**
7	3.3	3.1	**-0.2**	2.9	2.5	**-0.4**	3.1	2.8	**-0.3**
8	2.7	3.2	**0.5**	2.9	2.3	**-0.6**	2.8	2.7	**-0.1**
9	2.5	3.1	**0.6**	2.5	2.2	**-0.3**	2.2	2.6	**+0.4**
10	3.2	3.2	**0.0**	3.3	2.5	**-0.8**	3.2	2.8	**-0.4**
13	2.9	3.2	**0.3**	2.7	2.1	**-0.6**	2.8	2.6	**-0.2**
Average Gain			**0.29**			**-0.41**			**-0.03**

Table 8

Woodcock Reading Mastery Test: Control Group Pre- and Post-Treatment Scores

Subjects	Word Comp. Pretest	Word Comp. Posttest	Gain	Passage Comp. Pretest	Passage Comp. Posttest	Gain	Reading Cluster Pretest	Reading Cluster Posttest	Gain
3	2.2	2.9	**0.7**	2.2	2.3	**0.1**	2.2	2.6	**0.4**
4	2.7	2.3	**-0.4**	2.6	2.8	**0.2**	3.2	2.6	**-0.6**
5	2.7	2.5	**-0.2**	2.9	2.3	**-0.6**	3.1	2.4	**-0.7**
6	1.8	1.7	**-0.1**	1.9	2.0	**0.1**	1.9	1.9	**0.0**
11	3.2	2.9	**-0.3**	3.0	2.6	**-0.4**	3.1	2.8	**-0.3**
12	3.4	3.3	**-0.1**	3.5	3.0	**-0.5**	3.5	3.1	**-0.4**
14	2.7	2.5	**-0.2**	3.0	2.5	**-0.5**	2.9	2.4	**-0.5**
Average Gain			**-0.09**			**-0.23**			**-0.30**

Chapter 5

Discussion

Conclusions

The purpose of this study was to determine whether learning disabled students receiving sensorimotor training; specifically the Brain Gym Program would improve in the area of reading comprehension, more than a group of learning disabled students not participating in the Brain Gym Program.

The above purpose gave rise to two possible hypotheses. The first hypothesis was that participation in the Brain Gym Program would lead to improvement in the area of motor skills. The second hypothesis was that participation in the Brain Gym Program would lead to improvement in the area of reading comprehension.

It was hypothesized that participation in the Brain Gym Program would lead to improvement in motor skills. All students were pre- and post-tested using the Lincoln-Oseretsky Motor Development Scale. The results reflected an improvement for both the experimental and control groups. The average score for the experimental group was slightly higher than that of the control group. However, the significant improvement of subject number fourteen (twenty-one points) most definitely increased the average of the control group. On an individual basis the students in the experimental group showed greater gains than those in the control group (except for subject number fourteen).

Also examined were the percentile norm averages for males and females ages six through fourteen. This data in Table 5 showed that the students in the experimental group scored in a higher percentile than those in the control group.

The data reflects that the entire class showed improvement in motor skills. Also to be considered is the score of subject number fourteen. This particular student (a member of the control group) showed a significant gain of twenty-one points. This individual score increased the average of the control group by two points. Overall, the scores of the experimental group were higher than those of the control group. However, the increase was not significant enough to justify the use of Brain Gym as a therapy for motor skill deficits.

Looking at the class averages there is no evidence that the use of the Brain Gym program increased the reading comprehension scores, in fact most of the averages decreased. Individually, the Word Comprehension scores for the experimental group do imply that there may have been improvement for those students using the Brain Gym program.

An overall review of the literature fails to support sensorimotor training as an effective method for improving reading comprehension abilities. Though there have been studies that are supportive of sensorimotor programs the majority of these studies lack significant proof of their claims.

Limitations

A serious limitation of this study was the length of the treatment program. If it had been possible, this researcher would have extended the length of time that the Brain Gym program was utilized. Also, the size of the research population should have been

larger to allow for more accurate data. Another limitation of this study was the time of year that the program was implemented. During the two weeks that the program was implemented the school was on a shortened schedule because of parent conferences and spring recess.

Implications for Future Research

Suggestions for further research would include expanding the study to a larger population, one which contained learning disabled students as well as their non-disabled peers. Data could be collected on the two groups and then compared to determine if the program is more successful with either population of students. Another modification to this research would be to extend the length of the program. The students would have an opportunity to learn the exercises and perform them with continuity. This study could also be performed using other academic or physical areas for testing.

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Appendix A

Lincoln-Oseretsky Motor Development Scale
Recalculated Percentile Norms for Males and Females

Chronological Age

Score	6	7	8	9	10	11	12	13	14
72									
70								99	
68							99	95	
66							96	91	93
64							92	85	86
62						97	87	75	65
60						92	82	60	45
58						87	74	49	22
56						81	64	35	10
54					97	75	54	22	5
52					93	65	42	9	
50				99	89	55	33	8	
48				97	84	45	23	4	
46				93	77	35	16		
44				89	68	25	10		
42			98	82	58	18	6		
40			94	74	47	12			
38			89	63	35	8			
36		96	82	50	26	4			
34		92	75	40	19				
32		85	63	28	13				
30		79	50	20	8				
28		69	38	13	4				
26	98	55	26	8					
24	93	43	19	4					
22	86	30	12						
20	80	20	6						
18	70	12							
16	60	7							
14	45								
12	33								
10	23								
8	15								
6	9								
4	5								
2									
0									

Appendix B

Lincoln-Oserestsky Motor Development Scale
Test Items

Task 1- Walking Backwards

Task 2- Crouching on Tiptoe

Task 3- Standing on One Foot

Task 4- Tap Rhythmically w/feet & fingers

Task 5- Jumping over a Rope

Task 6- Standing Heel to Toe

Task 7- Closing & Opening Hands Alternately

Task 8- Winding Thread

Task 9- Describing Circles in the Air

Task 10- Jump in Air, Land & Balance

Task 11- Putting Coins in Box

Task 12- Tracing Mazes

Task 13- Balancing on Tiptoes

Task 14- Tapping w/feet & fingers

Task 15- Jumping & Touching Heels

Task 16- Stand on One-Foot w/ eyes closed

Task 17- Jumping & Clapping

Task 18- Balancing on Tiptoe