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A Comprehensive Study of Advanced Tumbling and Gymnastics Skills Instruction Involving Fifth and Sixth Grade Boys and Girls in Benjamin Franklin Elementary School Grand Forks, North Dakota

Gordon E. Longmuir

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A COMPREHENSIVE STUDY OF ADVANCED TUMBLING AND GYMNASTICS
SKILLS INSTRUCTION INVOLVING FIFTH AND SIXTH GRADE BOYS
AND GIRLS IN BENJAMIN FRANKLIN ELEMENTARY SCHOOL
GRAND FORKS, NORTH DAKOTA

by

Gordon E. Longmuir

B.S. in Education, University of North Dakota, 1966

A Thesis

Submitted to the Faculty

of the

University of North Dakota

in partial fulfillment of the requirements

for the Degree of

Master of Science

Grand Forks, North Dakota
August
1967

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This thesis submitted by Gordon E. Longmuir in partial fulfillment of the requirements for the Degree of Master of Science in the University of North Dakota is hereby approved by the Committee under whom the work has been done.

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ABSTRACT

The purpose of this study was to determine whether selected fifth and sixth grade children were capable of increasing their gymnastic skills in an advanced program of instruction in tumbling.

An experimental group was requested to participate in the study. This group of thirty subjects (eight boys and twenty-two girls) experienced an advanced gymnastic program three times weekly for a two and one-half month period. This experimental group was further divided into boy and girl subgroups.

The experimental group was given a pre-test for four selected intermediate level stunts. The same items were also administered at the conclusion of the advanced gymnastic program.

Two statistical comparisons were made: (1) a within group comparison between the pre-test and post-test means of the group, and (2) a between group comparison of the means of the pre-test and the post-test for the boy and girl subgroups of the experimental group. The null hypothesis was assumed in analyzing the significance of the difference between means at the .05 level.

The results of the comparison showed a significant increase by the experimental group on all of the stunts tested. No overall significant difference between the boy and girl subgroups were evidenced on either the pre-test or the post-test.

It was concluded, on the basis of the results of the within group comparison, that selected fifth and sixth grade children were capable of increasing gymnastic skills through participation in an advanced tumbling program.

CHAPTER I

INTRODUCTION

The writer has observed that, in some schools, the fifth and sixth grade students were still doing the same basic tumbling skills and stunts that were introduced in the first grade. In addition, these fifth and sixth grade students seemed to find these areas of physical education very dull and uninteresting. The lack of progression and variation in tumbling and gymnastics activity seemed quite apparent. Was this group able to learn more advanced skills? Could they be challenged to attempt more interesting stunts?

The Problem and Its Scope

The problem of this study was to determine whether selected fifth and sixth grade children were capable of increasing their gymnastic skills through participation in an advanced program of instruction in tumbling.

Another phase of the problem was to determine whether these children could develop newly acquired skills and stunts into a gymnastic exhibition routine.

Delimitations

Participants in this study consisted of fifth and sixth grade boys and girls who attended Benjamin Franklin Elementary School in

Grand Forks, North Dakota during the first semester of 1966-67. The age of the subjects ranged from ten to twelve years.

All subjects were given a pretest before they were allowed to enter the program. The participants in the experimental program were tested for gymnastic skills both before and after the seven week experimental program, which was conducted from October 19, 1966 to December 16, 1966. The experimental group participated in the program three times a week, on Mondays and Fridays at noon hours from 12:20 P.M. to 12:55 P.M. and on Wednesday afternoons from 4:00 P.M. to 5:15 P.M.

Limitations

The fact that the program was run during noon hours for the most part should be kept in mind. This factor tended to limit the program to those children who lunched at school.

The school had on hand three small (size) and two large (size) tumbling mats. This limited, somewhat, the area to be used on the gymnasium floor with such a large group.

The experimental group consisted of volunteer students from the fifth and sixth grades. Thus, the children were not compelled to attend every practice as they would have been had the program been a part of the required physical education curriculum of the school.

Definition of Terms

Selection Test: The test used to select the students for the experimental program. Eight selected stunts to determine gymnastic aptitude were test items taken from the Iowa Revision of the Brace Test.

Gymnastic Program Preliminary Skills Test: The test used to determine the level of proficiency the experimental group had attained before the study program took place. Four test items were administered on an intermediate level.

Gymnastic Program Post Skill Test: The test used at the end of the program to determine the level of proficiency the subjects had attained after the experimental program was completed. This test included the same four stunts as did the preliminary test plus any other stunts the subjects had been exposed during the course of the program.

Tumbling Stunt: A basic motor skill which could cover extensively the mechanics of rolling, turning, springing, and twisting or any one or combination of the above factors.

Balancing Stunt: A stunt which requires various parts of the body to support body weight in a manner of maintaining equilibrium in any certain position.

Beginning Level: The first step in tumbling skill progression where the performer is just beginning or learning to do the simple stunts (a novice).

Intermediate Level: The second level of tumbling skills where the performer is in between the lower beginning level and the upper advanced level. The stunts performed here are more complex than those at the beginning. An example of such a stunt would be the back roll extension which evolved from the backward roll, a beginning level stunt.

Advanced Level: The third level of tumbling skills where the performer is skilled sufficiently to perform the more difficult tumbling stunts.

Self Testing Activities: Activities which require thinking and involve the use of judgment in skills such as: control, speed, timing, and judging distance.

Tumbling or Gymnastic Exhibition Routine: A program of a variety of stunts placed together in a continuous sequence and lasting a prescribed length of time.

Routine: A series of stunts executed in a straight line down a considerable length of mat surface.

Spotting: The mutual physical assistance between performers, or between the instructor and performers, to insure safety.

Need for the Study

Tumbling and gymnastics over the past few years have come into prominence at the elementary school level under the heading of self testing activities. More and more of the total physical education time has been devoted to these activities. The North Dakota Elementary Physical Education Guide,¹ stated that, in the fifth and sixth grades, self testing activities should take up twenty-five per cent of the total physical education time. If this type of activity is to benefit the needs and desires of elementary children, it seems logical that there should be a skill progression from simple to complex from the first through the sixth grades respectively.

In essence, this does not really seem to occur. In many elementary schools, sixth grade children are performing over and over

¹Physical Education Guide for Elementary Schools, State of North Dakota, Department of Public Instruction, Bismarck, North Dakota, (1960), p. 8.

again the same stunts they learned and performed as first and second graders.

Nagel² claimed that during the pre-school years, children's stunt play had dominated their everyday movements. They loved to jump, climb, roll, fall down and imitate. After they entered school, activities changed to small and large group games and dances which did not meet sufficiently the needs for total mental, social and physical development. Self testing activities could meet these needs if one began with the simple stunts and progressed to the more complex. Squad organization, squad leaders and progressive activities which cover agility, flexibility, balance and strength are factors which may help to meet the large muscle needs of children.

The writer had one more reason for making this study. The hope was that many of the older theories and beliefs that elementary school students were not physically capable of performing advanced stunts and skills could be cast in doubt. Certain authors claimed that girls at the upper elementary level should not or could not perform many of the same stunts that boys of this age level are capable of doing.

Girls should participate in the simpler mat stunts. Fundamental differences in skeletal structure between the boy and girl do exist. The bones of a girl are lighter and her pelvis is much broader, also her shoulder is weaker. The girl should not be expected to achieve the same standards as the boy. Rather should she have activities of her own, adapted to her peculiar anatomical, physiological and emotional needs.³

²Charles Nagel, "A Stunt Play Program for Children," Journal of Health Physical Education and Recreation, (May 1952), p. 29-30.

³Martin Rogers, A Handbook of Stunts (New York: The MacMillan Company, 1936), p. 234.

Roger's statement challenged the investigator. Was it possible for girls at the upper elementary school level to attain the same skill levels as boys in many of the advanced stunts? Were the older ideas and statements about these youngsters true? Could this age group do more in tumbling and gymnastics than had been expected?

From the foregoing statements, it seemed there was a definite need for a study which was concerned with advanced tumbling and gymnastic skills for fifth and sixth grade children.

Review of Related Literature

Studies and experiments which attempted to conduct or evaluate advanced elementary school tumbling programs are somewhat limited. The review of materials available to this investigator has not revealed any studies in the area of teaching advanced tumbling and gymnastics to children of upper elementary school age.

The review of the related literature in this study was done with reference to the various tumbling and gymnastic programs used in American elementary and secondary schools. The investigator felt these studies had sufficient bearing on this study to be mentioned here.

Parry⁴ conducted a study in which he tested 471 fourth, fifth and sixth grade boys to determine the learning process in tumbling for the elementary grades. At the end of a three month practice period it was found that the fourth graders had the most ability in learning the stunts.

⁴Kenneth R. Parry, "The Learning Process in Tumbling for the Elementary Grades," Research Quarterly, (Vol. 21, No. 2, May, 1950).

Davis⁵ conducted a study in which he tried to place certain selected tumbling and balance stunts at various grade levels. Davis took into consideration the various skill levels of the children in that grade or age group. He found that at the elementary level there were no hard and fast rules as to which stunts could be learned faster at any given level. He concluded that certain stunts should be introduced at earlier grades and certain others at later grades as determined by the results of the test the children took.

Wickstrom,⁶ in his study of teaching tumbling and gymnastics to college freshmen, concluded that the whole method is more effective than the whole direct repetitive method. At both the elementary and the intermediate levels of difficulty the whole method proved superior.

Hill⁷ made a study which was concerned with educational gymnastics. She found that progress in the child's learning of a skill or stunt was determined by the individual's innate capabilities, previous experience, stage of physical development, needs and interests.

There is evidence, in view of the limited studies in this area, that more studies of this nature should be undertaken. The investigator reviewed from sources other than studies and felt that the following information was pertinent to the study of tumbling and gymnastics on the elementary level.

⁵Rex S. Davis, "Placement of Selected Tumbling and Balance Stunts in the Elementary School Physical Education Program" (unpublished Master's Thesis, Washington State University, 1961).

⁶Ralph L. Wickstrom, "A Comparative Study of the Methodologies for Teaching Gymnastics and Tumbling" (unpublished Master's Thesis, University of Iowa, 1952).

⁷Rose M. Hill, "Educational Gymnastics for the Teacher of Physical Education" (unpublished Master's Thesis, University of Iowa, 1962).

Earlier writers, such as LaSalle,⁸ and Neilson and Van Hagen,⁹ felt that tumbling and gymnastics should be a part of the required physical education program for elementary school children. LaSalle used the term "self testing activities" to describe the tumbling stunts taught from the first through the sixth grades. Neilson and Van Hagen used the word "stunts" to describe the tumbling activities taught from the third through the sixth grades.

More recent writers such as O'Keefe and Aldrich,¹⁰ Fait,¹¹ and Vannier and Foster¹² have used the term "self testing activities" to include graded stunts, small apparatus work and tumbling. These activities are all begun at the first grade level and are carried on through the sixth grade. These more recent writers present a more detailed list of activities on a graded progression from simple to complex from the first through the sixth grades.

Arthur G. Miller and Virginia Whitcomb¹³ discussed the place of tumbling and gymnastics in the elementary school curriculum. They

⁸Dorothy LaSalle, Guidance of Children Through Physical Education (New York: A. S. Barnes and Co., 1964), p. 255.

⁹N. P. Neilson and Winifred Van Hagen, Physical Education for Elementary Schools (New York: The Ronald Press Co., 1956), p. 28.

¹⁰Patricia Ruth O'Keefe and Anita Aldrich, Education Through Physical Activities (St. Louis: The C. V. Mosley Co., 1959), p. 135.

¹¹Hollis F. Fait, Physical Education for the Elementary School Child (Philadelphia: W. B. Saunders Co., 1964), p. 288.

¹²Maryhelen Vannier and Mildred Foster, Teaching Physical Education in Elementary Schools (Philadelphia: W. B. Saunders Co., 1954), p. 208.

¹³Arthur G. Miller and Virginia Whitcomb, Physical Education in the Elementary School Curriculum (Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1957), p. 12.

claimed that this type of activity was important at this level.

Stunts, tumbling and apparatus activities strongly appeal to children, and, if properly chosen and presented, form a valuable part of the physical education program.

Such activities can do more toward developing the body physically through the use of big muscles and development of agility, flexibility, balance and strength than can be accomplished through any other aspect of the physical education program.

Self testing in nature these activities offered each child, regardless of the body build, not only the opportunity to participate to the fullest, but also to prove himself and to achieve satisfactory measure of success by his own efforts. Such success calls for competition with himself and builds up confidence, courage and perseverance in a child while demanding cooperation rather than competition with others.

Keeney¹⁴ stated that, whether one's intentions and ambitions were confined to the lower echelons of tumbling or fixed on a much higher goal in terms of skill, there has to be a beginning to the learning process and a systematic, step by step progression from one skill to another. The degree of pleasure experienced from the activity, the safety of the performer and the steady advancement in tumbling prowess depended upon learning each stunt and skill correctly and with fair precision.

A good gymnastic program can solve some of the basic problems confronting physical education in schools today. First, it helps to develop a part of the body neglected by Americans--the upper arms and shoulders. Second, gymnastic units can effectively involve large classes which seem to be unavoidable. Third, gymnastic activities lend themselves admirably to different levels of ability. Students with highly developed skills can work on advanced techniques. Gymnastics add variety and challenge, zest, and fun to the physical education class.¹⁵

¹⁴Charles J. Keeney, Fundamental Tumbling Skills Illustrated (New York: The Ronald Press, 1966), p. 4.

¹⁵Janet Narowitz, Ami Leso, Tom Vodola, Bill Hellman and John Piscope, "Gymnastics," Journal of Health, Physical Education and Recreation, Vol.35, No. 8, (October, 1964), p. 21.

Loken and Willoughby¹⁶ stated that a great deal is happening in gymnastics. It is being rediscovered that, with proper supervision and instruction, gymnastics can be one of the most popular and exciting activities in the school program.

In addition, they also felt it was very important that the necessary progression be used in learning tumbling skills.¹⁷ No one learns to run before he can walk. By the same token, somersaults should not be attempted before the basic fundamentals have been successfully mastered. Too many instructors have tried to push the class too rapidly. This often results in the development of bad habits and leads to many injuries. Fundamentals cannot be stressed too heavily.

In teaching gymnastics and tumbling, the lesson plans should proceed progressively from the simple to the complex. Progressive lead up activities should be given which contain elements identical with the desired end. Relatively complicated coordinations are part of all gymnastic feats, and in order that they may be learned correctly they should be broken down into parts and learned separately.

The participants should not be allowed to practice too long without some success. It seems best, then, to teach moderately easy lead ups and to provide an individual mat area (even though small) for each one or two performers. Thus the inevitable mistakes may be made without attracting undue group attention.

Motivation through competition and exhibition stimulates interest in gymnastics and tumbling, and provides added interest to the participants. The competent performer should be encouraged to create routines that have continuity and unity instead of learning the set routines of the instructor.¹⁸

¹⁶Newton C. Loken and Robert J. Willoughby, A Complete Book of Gymnastics (Englewood Cliffs, N. J.: Prentice Hall Inc., 1959), p. 3.

¹⁷Ibid., p. 19.

¹⁸Hartly D. Price, Charles Keeney, Joseph Giallombardo and Chester W. Phillips, Gymnastics and Tumbling (Menasha, Wisconsin: The George Banta Company Inc., 1961), p. 24.

Summary of Related Literature

From the review of literature, it is evident that tumbling and self testing activities constituted a large part of some American elementary school physical education curriculums. The degree to which these activities are stressed varies greatly from place to place.

Researchers have reported that certain stunts belong at specific grade levels. However, there appears to be no general agreement as to the appropriate age and/or grade level in which or at which advanced gymnastic skills can be included in the physical education program. Researchers agreed that tumbling and gymnastic stunts should proceed progressively from the simple to the complex from the first through the sixth grades.

CHAPTER II

METHODOLOGY

Introduction

It was difficult to determine the best program that would satisfy the needs of elementary school students in the area of tumbling. Permission had been granted to the investigator to experiment with the more advanced fifth and sixth grade students of Benjamin Franklin Elementary School of Grand Forks, North Dakota. The decision was made to investigate methods of presenting tumbling techniques to these students. An experimental group in a test re-test situation was utilized. A boy to girl comparison was also used to see if there were any differences in learning ability. The decision was finally made to use activities in stunts and tumbling which were usually presented to students in junior and senior high school classes.

Description of the Groups Used in this Study

Experimental Group: This group of six fifth graders and twenty-four sixth graders was selected as a result of scores on eight selected stunts administered from the Iowa Revision of The Brace Test. These stunts were believed helpful in determining the possible gymnastic aptitude the children had at this particular time.

Boy and Girl Subgroups: As a result of the information gathered in the first chapter which stated that elementary school age girls should be confined to simpler mat stunts than boys because of their anatomical structure, this investigator decided to try to determine whether there was a difference in the learning abilities of elementary school boys and girls. It was decided to use boy and girl subgroups consisting of eight boys and 22 girls whose pre-test and post-test scores were to be compared to one another to determine whether there was a significant difference between the two groups in learning ability.

A brief description of the stunts used on the selection test as taken from McCloy and Young¹ is as follows:

1. Iowa Test number (8). Double-Heel-Click Test. Jump upward, clap feet together twice and land with feet apart (any distance). Failure: (a) not to clap feet together twice; (b) to land with feet touching each other.

2. Iowa Test number (10). Jump-Foot Test. Hold toes of one foot in opposite hand. Jump upward, with free foot jumping over the foot that is held. Do not release the hold of the foot. Failure: (a) to release the foot that is held; (b) not to jump through the loop made by foot and arm.

3. Iowa Test number (17). Cross-Leg-Squat Test. Fold arms across chest. Cross feet and sit down. Get up without unfolding arms and without moving feet about to regain the balance. Failure:

¹Charles Harold McCloy and Norma Dorothy Young, Tests and Measurements in Health and Physical Education, (New York: Appleton-Century Crofts, Inc., Third Edition, 1954), p. 88.

(a) to unfold arms; (b) to lose the balance; (c) not to get up.

4. Iowa Test number (22). One-Knee-Balance Test. Right face, kneel on one knee, with other leg raised from the floor and with arms raised sideward to the level of the shoulders. Hold the position for five counts. Failure: (a) to touch the floor with any part of the body other than one lower leg; (b) to fall over.

5. Iowa Test number (23). One-Knee-Head-to-the-Floor Test. Kneel on one knee, with the other leg raised behind the body and not touching the floor, and with arms raised sideways to the level of the shoulders. Bend trunk forward, touching head to the floor, and raise head from the floor without losing the balance. Failure: (a) to lose the balance; (b) not to touch the floor with the head; (c) to touch the floor with any part of the body other than head and leg supporting the weight of the body.

6. Iowa Test number (29). Russian-Dance Test. Squat. Raise one leg forward. Perform a Russian dance step by extending legs alternately while in a squat position. Perform four such steps, that is, two with each leg. Heel of forward foot may touch the floor. Heel of rear foot should strike hip on that side. Failure: (a) to lose the balance; (b) not to do the stunt twice with each leg.²

7. Iowa Test number (30). Top Test. Sit with lower legs flexed, on the floor. Put arms between legs, and under and behind knees, and grasp ankles. Roll rapidly around to the right, with the weight first over the right knee, then over the right shoulder, then

²Ibid., p. 89.

on back, then on left shoulder, then on left knee. Sit up facing the opposite direction from which the test was started. Repeat the movements from this position and finish facing the same direction from which the test was started. Failure: (a) to release hold of the ankles; (b) not to complete the circle.

8. Iowa Test number (31). Single-Squat Balance Test.

Squat on either foot. With hands on the hips raise one leg forward. Hold this position for five counts. Failure: (a) to remove hands from hips; (b) to touch the floor with raised leg; (c) not to hold the balance for five seconds.³

In a factorial analysis of the Iowa Brace Test the following six factors were identified:

1. Dynamic Energy
2. Flexibility
3. Balance
4. Semi-circular canal balance
5. Insight into the nature of the stunt
6. Arm control.⁴

Price, Keeney, Giallombardo and Phillips⁵ stated that power, upper body strength, muscular coordination, flexibility, balance, and agility and self confidence were essential qualities in a successful gymnast. The Iowa Brace Test seemed to include all of these qualities. Therefore, the investigator felt the use of this test

³Ibid., p. 90.

⁴Ibid., p. 91.

⁵Hartley D. Price, Charles Keeney, Joseph Giallombardo and Chester W. Phillips, p. 11-12.

would help to determine those students with gymnastic capability or potential.

A panel of two so-called "expert judges" was set up to judge or score the children on the selection test (Iowa Brace), on the gymnastic preliminary skills test and on the final post-experimental program skills test. The panel graded the selection tests on a straight pass or fail basis. Each child was given two chances to perform and pass the stunt. All those who passed four of the eight stunts on either first or second trials were chosen to take part in the study on a volunteer basis.

Letters were sent home to the parents. Permission was requested to allow their child to take part in the program and to release the school from liability in the case of injury. A copy of this letter may be found in Appendix C.

Description of the Pre-Program Skills Test Used in the Study

The study began on October 19th with the administration of the Iowa Brace Test. On October 24th, all the children with signed release slips took the skills test for selected intermediate level stunts. The children were graded on their first attempt whether or not they had ever tried the stunt previously. The panel of experts graded each student on each stunt on a gymnastic rating scale of 10. The child did not have to attempt the stunt if he did not wish to, in which case he received a score of zero.

The stunts selected and used for this pre-test were the backward roll extension, the squat headstand, the handstand and the forward handspring. A brief description of each stunt taken from Loken and Willoughby is as follows:

1. The back roll extension.⁶ This is a variation of the back roll in which the performer momentarily passes through a handstand position and snaps the legs down to the floor. As the performer pushes with the hands, he fully extends the arms and shoots the feet upward to a momentary handstand. When in the handstand position he bends the knees slightly and snaps the legs down, pushes with the hands so that his whole body will be completely off the mat. Finish the stunt in a standing position.

The important thing to stress here is to shoot straight up toward the roof with the legs, while, at the same time, pushing up with the arms. If the performers have trouble getting their legs straight up at first then allow them to go back and not so high.

2. Squat Headstand.⁷ Start this stunt from a squat position with the hands on the mat and the insides of the knees resting on the elbows. From this position lean forward and place the head on the mat. Raise the feet upward over the head. Do this slowly and the balance will be maintained more easily. Be sure to maintain a triangular formation with the head and the hands and keep the back neatly arched. Also, rest the head on the forward part and not the very top or back side of the head. To come down from this stunt, either duck the head or do a forward roll or return the legs to the mat in the opposite manner as they were put in position.

3. The Handstand.⁸ Place the hands on the mat shoulder

⁶Loken and Willoughby, p. 22.

⁷Ibid., pp. 36-37.

⁸Ibid., pp. 36-37.

width apart with the fingers pointing forward. With the head up, kick upward having a spotter standing close in front to grab the legs and hold the performer in a hand balance position. Little by little, the spotter can release the legs of the performer, and, finally, a free supporting hand balance will be accomplished. In the final hand balance keep the head up (eyes looking forward slightly) back arched, and hands pointed forward with fingers gripping the floor and arms straight.

If spotters are not available, the performer may try the stunt against the wall. It is very important here to stress locking out the elbows, keeping the arms straight so as not to bend at the elbow and allowing the body to touch the floor and keeping the head up. The fingers should be able to control the balance.

4. Front Handspring.⁹ Take a good run, skip on the right foot and bring the left foot forward. Place the left foot on the mat, bend forward at the waist and place both hands about twenty-four inches ahead of the left foot. Kick the right foot overhead followed by the left. As the feet are being carried overhead, the arms should be held straight and the eyes trained on a spot about six inches in front of the hands. As the body passes through the handstand position, push off the mat with the shoulders and wrists without bending the arms. Continue on over to the feet and land with the knees flexed.

To learn the handspring, the performer should begin from the standing position. Place the hands on the mat in front of the rolled mat, and, with the aid of spotters, kick up to a handstand. Arch

⁹Ibid., pp. 25-26.

over the rolled mat. Two spotters should assist the performer throughout this archover. Then try the stunt with a small run and execute a front handspring over a rolled mat. The next step is to remove the mat roll.

Description, Explanation and Administration of the Skills
and Stunts Taught in the Study Program

The basic stunts and gymnastic exercises used by the investigator in this study were of two types: (1) tumbling stunts and (2) balancing stunts.

The tumbling stunts included: forward roll, backward roll extension, shoulder roll, small dive roll, running dive roll, double roll, pig walk, caterpillar walk, backlift, shoulder knee spring, peanut shuffle, headspring, neckspring, front handspring, back handspring, one and two handed cartwheels, belly or dirty face roll, front walk-over handspring, back walk-over handspring, front flip, roundoff, and combinations or routines down the length of a row of mats.

The single balancing stunts included: squat hand balance, squat head balance, headstand, handstand and forearm balance.

The double balancing stunts included: the thigh balance, chest balance, shoulder knee balance, pyramid building and two-high balance.

The first day of actual instruction in the study program was October 27. At this time the group was instructed in the first fundamental basic skill, the forward roll. From here, in a basic day by day progression, the experimental group moved from the simpler stunts to the more complex. The lessons were concluded with the tumbling exhibition routine. This routine was presented at a school

assembly program on December 16, 1966.

A description of each individual stunt taught to the experimental group throughout the program is as follows:

1. The forward roll.¹⁰ From a squatting position, place the hands on the mat about shoulder width apart. Place the chin on the chest and lean forward, pushing with the feet and bending the arms. Allow the back of the shoulders to touch the mat first as the roll is executed and continue rolling on over the back. When the shoulders touch the mat, take the hands from the mat and grasp the shins, pulling the body into a tight tuck. Roll forward in this small ball up to the feet and then straighten up to a standing position.

2. The backward roll.¹¹ Start from a squatting position with the hands on the mat and the knees between the arms. Lean forward slightly and then move backward into the roll. Push with the hands above the shoulders with the fingers pointed back and palms up. Keep the chin on the chest throughout the roll. Roll over the top of the head and onto the hands, keeping the knees tucked into the chest. Push with the hands and continue the roll to the feet. Finish in a squat position.

If the performer has trouble getting over, teach him the rocker. Have him round his back, tuck his chin on his chest and rock in a tucked position back and forth. Next add the hand action of pushing when up on the shoulders. The complete backward roll is the last stop.

¹⁰Ibid., p. 20.

¹¹Ibid., p. 21.

3. The backward roll extension. This stunt was explained as the number one stunt in the pre-program skills test on page 17 Number 1, and was taught to the group in the same manner as explained there.

4. The shoulder roll.¹² Stand at the end of the mat with the feet spread slightly. Lean forward and throw the left arm toward the mat looking between the legs. As the arm is thrown, strike the mat with the elbow first and roll up the arm, across the shoulders and back, and end up on the feet facing sideways. The right arm can be used to push the performer to his feet.

5. The small dive roll. Start from a squatting position and reach up in the air over the shoulders extending the legs fully. Place the chin on the chest and lean forward. The hands should touch the mat first carrying the body weight onto the mat easily so the weight is distributed on the shoulders, back and then feet as the body goes through the forward roll position.

Begin this stunt by doing nothing more than an extended forward roll. Each time the stunt is repeated try to get a little higher. Stress carrying the weight on the hands.

6. The running dive roll. Start in a running position and take a headfirst leap into the air from a twofoot takeoff. Land on the hands carrying the weight easily onto the mat and follow through as in a forward roll.

7. Double forward roll.¹³ Start with one partner lying on the mat with his feet in the air while the other stands at his head

¹²Ibid., p. 21.

¹³Ibid., p. 31.

in a straddle position. They grasp each other's ankles. Then the top man dives forward into a forward roll taking the bottom man's feet down toward the mat with him. The roll brings the bottom man up onto his feet and he in turn dives forward.

8. The double backward roll.¹⁴ Start in the same position as in the double forward roll. The top man sits down pulling the bottom man's feet back with him. The bottom man executes a backward roll pushing up vigorously with his hands. Thus, the positions of both men are now reversed and the stunt may be continued in a steady roll backward down the mat.

9. The pig walk - or monkey walk.¹⁵ Partner A stands with his legs spread while partner B lies on his back between A's legs facing the same direction as A. Partner A bends forward placing his hands on the mat while partner B places his legs around A's waist, reaches upward and holds around A's buttocks, fingers clasped together. A then moves forward carrying B. Partner A may roll left or right and B, after hanging on, may return to the starting point carrying A.

10. Caterpillar or Tandem walk.¹⁶ Partner A bends forward placing his hands on the mat, fingers well spread while partner B stands in front of A, facing the same direction and bends forward placing his hands on the mat, fingers well spread. Partner B raises his feet upward onto A's shoulders. Both walk forward.

¹⁴Ibid., p. 31.

¹⁵Price, Keeney, Giallombardo, and Phillips, p. 352.

¹⁶Ibid., p. 353.

11. The shoulder knee spring.¹⁷ The bottom man lies on his back with his knees raised and slightly spread. The top man approaches toward the feet and, with a short run, places his hands on the bottom man's knees. As the top man performs a headspring motion, the bottom man assists him by placing his hands on the shoulder blades of the top man. The top man continues over and lands feet first beyond the head of the bottom man.

This stunt should begin with two spotters and should not be learned until the headspring, neckspring and handspring have been mastered. Teach the performer to lean out over the bottom man's hands, keep his arms straight and head up as he goes over. If he goes over too far, he may come out of it with a forward roll.

12. The headspring.¹⁸ Take a slight run, jump, and land on the mat with both feet at the same time. Place both hands on the mat with the top of the head about six inches in front of the hands as though doing a headstand. Push off the feet keeping the body in a deep piked position with the legs straight. The hips are carried over the head until the body weight falls off balance down the mat. Whip the legs overhead from the waist and on toward the mat in one continuous arch, simultaneously pushing with the hands. Land on the feet with the knees bent slightly depending on how high the headspring is executed.

This stunt should be learned from a rolled mat with the use of a spotter. First try the stunt from a standing position. Place

¹⁷Loken and Willoughby, pp. 31-32.

¹⁸Ibid., p. 28.

the hands on the near side on top of the rolled mat with the head on the far side as though going to a headstand. Move the feet close to the mat roll, keeping the body in a deep pike position until the body weight is off balance down the mat. At this point whip the feet overhead from the waist and then down to the mat in one continuous arch pushing with the hands. Land on the feet. The next step is to remove the mat roll.

13. The neckspring.¹⁹ From a straight sitting position roll backward and place the hands on the mat behind the shoulders with the fingers pointing toward the shoulders and with the thumbs by the ears. Bring the knees up to the chest keeping them apart so that they pass on each side of the head. The legs should be straight. From this position, the shoulders roll forward, and, at the same time, (a) whip the legs forward at about a 60° angle and arch the back, and (b) push off the mat with the hands and back of the head and continue the whip of the legs until the body lands in a squat position on the feet.

This stunt can be learned from the rolled mat also. Start from a forward roll position onto the mat. As one moves into the roll and touches the back of the neck, extend the legs to the pike position and wait until one begins to fall. At this time, snap the legs and arch up with the back, pushing off with the hands, neck and shoulders.

14. The front handspring.²⁰ Take a good run, skip on the right foot and bring the left foot forward. Place the left foot on

¹⁹Ibid., p. 24.

²⁰Ibid., pp. 25-26.

the mat, bend forward at the waist and place both hands about twenty-four inches ahead of the left foot. Kick the right foot overhead followed by the left. As the feet are being carried overhead, the arms should be held straight and the eyes trained on a spot about six inches in front of the hands. As the body passes through the handstand position, push off the mat with the shoulders and wrists without bending the arms. Continue on over to the feet and land with the knees flexed.

15. The back handspring.²¹ Start from a standing position with the feet about shoulder width apart, and the arms held straight out in front of the body. Swing the arms downward, simultaneously bend the knees and sit back as though sitting in a chair. As the body falls off balance backward, swing the arms up overhead, simultaneously forcing the head backward. Straighten the legs and push off the mat with the toes, force the hips upward and make a big circle with the hands. As the hands land on the mat the body is approaching a handstand position. From this position, snap the legs down from the waist and land in a standing position.

Use spotters for each of the stunts, and, if possible, use a spotting belt. Allow the body to relax before the stunt is attempted as tightness hinders progress. Stress throwing back the arms and head and keeping the eyes open to see the mat coming around.

16. The two handed cartwheel.²² This activity is described going to the left. Start with the left side facing down the mat with the legs and arms outstretched and apart as in the spokes of a wheel.

²¹Ibid., p. 28.

²²Ibid., p. 22.

Rock to the right side by placing the body weight on the right leg and lifting the left foot off the ground. Then rock back to the left by placing the body weight on the left leg. Bend to the left side at the waist and place the left hand on the mat about two feet to the side of the left foot. Force the right leg overhead and simultaneously push off the mat with the left leg. As the feet approach the handstand, place the right hand on the mat about shoulder width from the left hand. At this point, the body is in a handstand with the legs held straight and apart and back arched slightly.

As the body passes through the handstand from the side, bring the right foot down on the line established by the left foot and hand by bending to the right at the waist. The left foot will follow to the mat and one finishes facing the same direction as at the start.

Stress the elbow lock, keeping the head up and using a good skip, hop into the stunt. Stress a four count landing on the mat - one arm, the other arm, one foot and the other foot all separately.

17. The one handed cartwheel.²³ Lean in the direction of the stunt and place the inside hand down to do a cartwheel without using the other arm. At first the stunt may have to be done in a arch basis just as in learning the two arm cartwheel. As skill progresses, it may be done correctly with the legs extended straight overhead and the body straight.

18. The belly roll or dirty face roll. Begin from a squat position and go into a back roll extension. From the handstand position of the back roll extension, slowly bend the elbows bringing the

²³Ibid., p. 23.

weight in slowly to the mat. At the same time the body remains extended and the back is arched pushing out the chest and stomach. As the body is brought into the mat, the weight is slowly transferred from the arms to the chest, stomach, then thighs. Once the body is rocked from the chest to the thighs, the legs are quickly brought back to the squat position in a hop up fashion.

Begin this stunt by lying on the mat face down, arms stretched over the head. Arch the back and do a rocker, rocking back and forth on the stomach, lifting first the arms off the ground and then rocking forward and then lifting the feet off the ground.

The next step is to do a handstand and lower the body into the same rocker as described above. Finally, the last step is to go from the back roll extension to the belly roll.

19. The forward somersault or front flip.²⁴ Take a good run, hop on the left foot, bring the right foot forward, simultaneously raise both arms overhead and land on the mat with both feet at the same time (hurdle). It is important here that the hurdle step be short and fast so the forward motion established by running may be directed upward. Throw the arms upward, forward and downward, and place the chin on the chest. Continue the circular motion with the hands by grasping and pulling the shins into a tuck position. The chest should be close to the knees and the heels close to the buttocks. After completing the somersault, shoot out of the tuck and land in a standing position on the mat.

Begin the stunt by rolling up a mat and placing it

²⁴Ibid., p. 27.

lengthwise on top of another mat. Have the performer begin by simply running up to the mat and doing a forward roll placing the hands on the rolled up mat. The next step is to do the forward roll without putting the hands down, landing on the back and grabbing the knees. From here, have the performer do a high dive roll, tuck and spin and come around as far as possible on top of the rolled up mat. As the performer attains height, have him tuck tight, spin quickly and open to land on top of the mat on both feet.

From here, the stunt may be attempted on a double layer of mats and then finally the single layer.

Spotters may be used at the sides of the rolled up mat at any time and can help bring the performer around by simply slapping on the buttocks, thus pushing the individual around to his feet. Stress that, once the performer has begun to do the stunt, it should be carried on through to the end. Never try to stop once started.

20. The roundoff.²⁵ This activity is described going to the left. Take a good run, skip on the right foot and bring the left foot forward. Place the left foot on the ground, bend forward at the waist and place the left hand on the mat about two feet in front of the left foot. Kick the right foot overhead followed by the left and place the right hand on the mat in front of and slightly to the left of the left hand. As the stunt progresses the hands and arm pivot in the same direction and the body turns. The fingers of both hands are pointing toward the edge of the mat. When the feet pass overhead execute a half turn left. Snap the feet down from the

²⁵Ibid., p. 23.

waist and push off the mat by extending the shoulders and flexing the wrists. Land on both feet, facing the direction opposite from that of starting. When the feet strike the mat, bounce off the balls of the feet.

Begin the stunt by rising to a handstand position and snap the feet down by a quick whip action downward of the legs. As soon as the legs hit, throw up with the hands and bounce off the balls of the feet, thus jumping high in the air.

21. Front walkover handspring.²⁶ Start from a standing position. The performance is nearly the same as for the handspring except that the straight arm, head up kickup through the handstand need not be as forceful. The hands, arms, and head maintain their positions until the foot lands and accepts the body weight. Only then are the hands lifted from the mat or floor. The full and complete body arch (hyperextension) is essential to the performance of these stunts. When the landing is on one foot with a step-out to the other, the stunt is called a walkover. In the walkover, the legs usually maintain their kickup split all the way to the landing.

The essential prerequisite for this stunt is the ability to arch the back a great deal. If the performer cannot do a hollow back or stand up handspring, then this stunt should not be attempted.

22. The back walkover handspring.²⁷ Start by arching backward, feet approximately a short walking distance apart. Throw the hands backward to the mat while a vigorous kick is given with the

²⁶Keeney, p. 58.

²⁷Ted Burns and Tyler Miculeau, Tumbling Techniques Illustrated, (New York: The Ronald Press Company, 1957), p. 50.

free leg. Come out of the handstand as if to walk backwards through or by means of a backward walkover. Repeat in series gaining distance in approximately walking strides. As speed is developed, try for enough lift from the kicks to get over, touching fingertips only lightly.

The essential factor of this stunt is being able to perform the back bend placing the hands back on the floor from over head and almost grabbing the heels.

23. The squat head balance.²⁸ Start from a squat position with the hands on the mat and the insides of the knees resting on the elbows. From this position, lean forward and place the head on the mat. Lift the toes from the mat so that the balance is on the head and hands, thus placing the performer in the squat head balance.

24. The squat hand balance.²⁹ Start from a squat position with the arms shoulder width apart with the insides of the knees resting on the elbows. Lean forward, keeping the head off the mat, and lift the feet into the balance position. Maintain the balance by working with the arms and pressing with the fingers.

25. The squat headstand. This stunt was explained as the number two stunt in the pre-program skills test on page 17, number 2, and was taught to the group in the same manner as explained at that time.

26. The handstand. This stunt was explained as the number three stunt in the pre-program skills test on page 18, number 3, and was taught to the group in the same manner as explained at that time.

A description of each set of group stunts taught to the

²⁸Loken and Willoughby, p. 35.

²⁹Ibid., pp. 35-36.

experimental group throughout the program is as follows:

1. The thigh balance or stand.³⁰ Start this stunt by having both persons face the same direction. Then the bottom person squats down, bends forward and places his head between the top person's legs and lifts him (using the legs for lifting) into a sitting position on his shoulders. The top person then places the feet of the bottom person's thighs with toes pointed downward, and the bottom man places his hands just above the top man's knees. The bottom man leans backward and removes his head from between the legs and finishes by holding the top person on his thighs with his arms straight. The top person straightens upward and forces a neat arch in the body with the arms out horizontally, head and chest erect. To dismount from this position, the top man simply drops forward to his feet. The spotters should stand in front of the performers to assist in this stunt.

2. The chest balance.³¹ Start this stunt with one partner kneeling on all fours. The other partner slides both arms under the kneeling partner's chest and grasps the far side of partner. He places his chest on the kneeling partner's back. Then the top man kicks upward in a similar manner as the head balance, and finishes in a chest balance position on his partner's back. Stress keeping the head up to keep from going over. The investigator wishes to express here the importance of telling the performer on top to hang on to the bottom person even if he falls over. In this way the top person's feet will hit the mat first to break the impact of the fall.

³⁰Ibid., pp. 40-41.

³¹Ibid., p. 41.

3. The shoulder knee balance.³² One partner is in a supine position with his hands and knees raised and the feet on the mat close to the buttocks. The top person places his hands on the knees and his shoulders in the bottom man's hands. From this position kick up to a knee and shoulder balance. Be sure that the top person's arms are kept straight throughout this stunt, and that contact is made with the shoulders into the bottom man's hands before kicking upward into the balance. The spotter can stand by the side of the performers to assist in reaching the balance position.

4. Pyramid building. Combinations of balancing stunts were put together to form pyramids. A favorite pyramid used in the exhibition routine was the dive roll pyramid. This was a three high pyramid using seven tumblers. The first performer comes out on the mat by doing a running dive roll and then gets down on his hands and knees in the middle of the mat across the width facing the audience. The second performer then dives over him and gets down on his hands and knees beside number 1. The third performer dives over the first two and gets down beside them. The fourth performer dives over the first three and then gets down on top of 1 and 2 on his hands and knees. The fifth performer then dives over the first four and gets down beside number 4 on top of 2 and 3 on his hands and knees. The sixth performer then dives over the first five and gets on top of 4 and 5 on his hands and knees. The seventh performer then runs toward the pyramid as if to dive over all six people piled three high. As he reaches the pyramid and begins to do his dive, the

³²Ibid., pp. 41-42.

number one tumbler in the pyramid calls out "now" and the pyramid collapses with the seventh performer diving safely across the top.

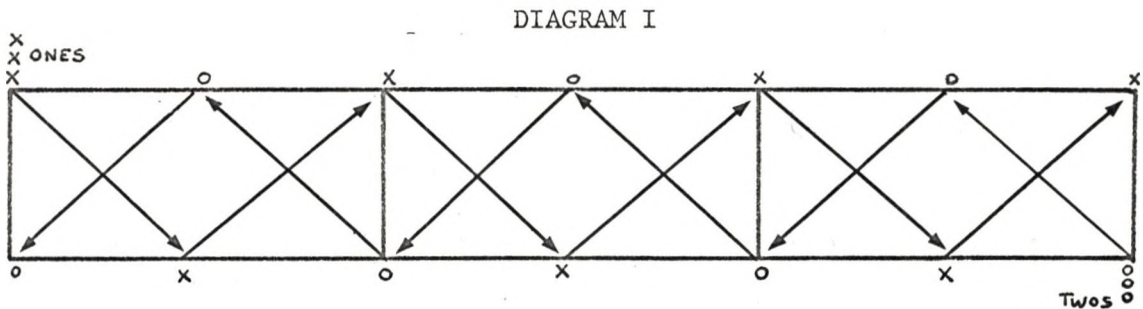
Two safety factors must be stressed here. First, the number one man must be alert and call for the pyramid to collapse on time, second, the performers in the pyramid must straighten their arms and legs out completely when collapsing so the people on the bottom will not be hurt.

5. The peanut shuffle (log rolling). Start the stunt by having numbers one, two and three take extended press up positions on the mat with their heads towards the audience. The backs should be straight with the body weight resting on the hands and toes. Number two (in the center) drops down and rolls toward number one. As number two rolls, number one springs from the mat with the hands and feet (still in the extended press up position), and immediately drops down and rolls toward number three. Number one then rolls toward number three, number three springs over number one, drops to the mat and rolls toward number two. Number two then dives over number three. The shuttle continues until the series has been gone through three or four times consecutively.

6. Cross rolling. Split the group into ones and twos. Have the mats together in one long length. Place the ones in the left corner of one end and the twos in the right corner of the other. Have one from each group do a forward roll diagonally across the mat using one-half of the length of the mat. These same people do a second roll until they are on the same side as they started and have used up one length of mat. Two people from each side can go (one new one from each side). After two more rolls by these four people,

one more from each side may go and so on until everyone has completed a series of rolls diagonally down the mats.

Each time a person is to roll, the instructor calls "ready roll." Before a new person can roll, he must wait until the person with the same group number in front of him has completed two rolls. See diagram I below.



Cross Rolling Positions on the Mats

A description of the complete sequence of stunts used in the tumbling exhibition routine at the end of the experimental program.

The routine was to last a maximum of twenty minutes. It was designed to utilize as many of the performers from the program as possible. The mats were placed in a long straight line together as shown in diagram I. All stunts were begun on command by the instructor. The first stunt was cross rolling in which all students participated. Then came the forward and backward rolls across the width of the mats. The group was divided into ones and twos. The ones did forward rolls across and then turned around and rolled back. Then the twos rolled similarly. The ones next did backward rolls across, turned around did backward rolls back again. The twos did the same. Everyone in the program also performed these stunts.

Next came handsprings down the length of the mats for everyone who could do the stunts.

The pig walk was next with one pair beginning from each end of the mat, walking into the center, rolling over, reversing positions and walking back out to the ends again.

The caterpillar walk was next with two groups of three people each walking the length of the mats, one from each side.

Front flips were next with all those who could do them performing the stunts.

The next stunt was the dive roll through a person doing a spread leg headstand. The performer doing the headstand would do a dive roll out on the mats and then go into a headstand and spread the legs. Quickly, one after another, other performers who could do a high dive roll, dove through the headstander's legs.

The next exercise was a series of dirty face rolls down the length of the mat by all those who could do them.

The peanut shuffle was next. Here two groups of three were used for demonstration purposes for one minute.

Next came series of stunts by all performers who had put small routines together down the length of the mats.

Next came the double balances. The first was the thigh stand in which the group was split into ones and twos. Everyone tried this stunt with the ones being on the bottom first and then switching around a few minutes later. The second was the chest balance with only those people performing the stunt who could maintain their balance.

Finally, to finish up the routine, came the pyramid with the seven best dive rollers taking part in it.

At the end of the entire routine, the performers lined up down the length of the tumbling mats facing the audience and bowed.

Description of the Post-Program Test Used in this Study

The post-program test consisted of the same four stunts used on the pre-program test, plus all other stunts the group had learned on which progress was sufficiently advanced to be tested. In all instances, only those children who could do the more advanced stunts well enough without risking injury were tested.

The original four pre-program stunts (the back roll extension, the squat headstand, the handstand and the forward handspring) were tested first. The other stunts on which tests were given, consisted of one and two handed cartwheels, the front flip, dive rolls through a spread leg headstand, dirty face rolls, a series routine down the mat, the thigh balance, the chest balance, the dive roll pyramid, back handsprings, back walkovers, the roundoff and the total overall tumbling exhibition routine.

The same panel of expert judges rated the performers on the 10 point gymnastic scale for each stunt and the total tumbling routine was also rated on the same scale. A copy of the National Collegiate Athletic Association and Amateur Athletic Union³³ scoring system can be found in Appendix C, page 83.

³³Barry L. Johnson, A Beginner's Book of Gymnastics, (New York: Appleton-Century Crofts, Inc., 1966), pp. 8-9.

Description of the Statistical Procedure to be Used
in This Study

All the raw scores were fed into the IBM 360 computer. The means, standard deviations, sampling error of means and "t" ratios were determined by this computer and the results were used in the analysis of the collected data.

Following the collection and computation of data, it became necessary to choose a method of analysis that would test the significance of the difference between the means on the pre-test and post-test for the experimental group and for the boy and girl subgroups within the experimental group. The null hypothesis was assumed in analyzing the difference between these means. This hypothesis asserts that there is no true difference between two population means and that the difference found between sample means, is therefore, accidental and unimportant.³⁴

There are several methods used in the null hypothesis. To make a within group comparison of the means for the experimental group, the "t" technique for testing the significance of the difference between means derived from correlated scores from small samples was suitable for use in this study.³⁵

To make between group comparisons of the means for the boy and girl subgroups within the experimental group, the "t" technique

³⁴Henry E. Garrett, Statistics in Psychology and Education, (New York: Longmans, Green and Co., 1958), p. 213.

³⁵Quinn McNemar, Psychological Statistics, (New York: John Wiley and Sons, Inc., 1949), p. 225.

for testing the significance of the difference between uncorrelated means appeared most suitable in this study. This test determined the ratio between the mean difference and the sampling error of the difference. This ratio was expressed as "t" and was verified in a table of "t."³⁶

For this study it was decided to retain the null hypothesis at the .05 level of confidence. This means that if the study were repeated one hundred times, ninety-five per cent of the studies would have similar results.

The final scores on the remaining skills not tested on the pre-test or first part of the post-test were all to signify a learning gain if they were any higher than zero, since the subjects were not believed able to do these stunts before the experimental program started.

The score on the tumbling routine was to indicate the amount of learning that took place within the complete group as concerned ability to use the knowledge and skill attained in the experimental program and combine them into a set pattern or routine.

³⁶Garrett, loc. cit., p. 449.

CHAPTER III

TREATMENT OF THE DATA

The purpose of this study was to determine whether or not participation in a systematic advanced tumbling instructional program for fifth and sixth graders could increase the skills of the participants. In addition, there was interest in whether or not a tumbling exhibition routine could be put together as a result of this program. The experimental group was given tests at the beginning of the program and then again at the end. The scores were compared in a test re-test situation. The girls pre and post-test scores were compared to the boys pre and post-test scores to determine whether there was a significant difference in the learning ability for these stunts for either group.

The selection test consisted of eight stunts from the Iowa Revision of the Brace Test, which were believed to indicate gymnastic aptitude. The scores of the participants were to determine whether they would be selected for the experimental program or not. The raw scores for the group were converted to percentile scores.

Results of the Selection Test

To qualify for the experimental group, it was pre-determined

that each student must pass four of eight possible stunts. Of the forty-eight children tested originally, thirty were selected to participate in the program. This meant that 62.50 per cent of all the pre-tested children were selected. Table 1 shows the raw scores on the stunts individually and the per cent of performers passing and failing (see Table 1, page 40.)

TABLE 1
PASS AND FAILURE PERCENTAGES OF THE SELECTION TEST

Stunt	Number Passed	Number Failed	Per cent Passed	Per cent Failed
1. Knee Balance	42	6	87.50	12.50
2. Double Heel Click	30	18	62.50	37.50
3. Cross Leg Squat	35	13	72.90	27.10
4. One Knee Head to Floor	20	28	41.60	58.40
5. Russian Dance	30	18	62.50	37.50
6. Top	28	20	58.30	41.70
7. Single Squat Balance	16	32	33.30	76.70
8. Jump Foot	2	46	4.10	95.90

Results of the Boy, Girl, Between Group Comparisons
of the Pre-Test

The "t" technique for testing the significance of the difference between the means was applied to the total of the judges' scores

for the boy and girl subgroups of the experimental group on the pre-test. The results were used to determine whether there was any significant difference between the boys' and the girls' scores on these four stunts before the experimental program began.

On the pre-test the boy subgroup had a judges' cumulative score of 6.63 and standard deviation of 3.54 for the backward roll extension as compared to the girl subgroup mean scores of 4.82 and standard deviation of 4.00. The critical ratio or "t" value was 1.13 which was not significant at the .05 level of confidence. The observed difference was considered to be due to chance and the boy and girl subgroups were considered equated for the backward roll extension (see table 4, page 44.)

For the squat headstand, the boy subgroup had a judges' cumulative score of .50 and standard deviation of 5.83 as compared to the girl subgroup mean scores of 5.73 and standard deviations of 4.97. The critical value or "t" ratio was .36 which was not significant at the .05 level of confidence. The observed difference was considered to be due to chance and the boy and girl subgroups were considered equated for the squat headstand (see table 4, page 44.)

For the handstand, the boy subgroup had a judges' cumulative score of 1.00 and standard deviation of 1.85, as compared to the girl subgroup mean scores of .27 and standard deviation of .70. The critical value or "t" ratio was 1.59 which was not significant at the .05 level of confidence. The observed difference was considered to be due to chance and the boy and girl subgroups were considered equated for the handstand (see table 4, page 44.)

For the forward handspring, the boy subgroup had a judges'

cumulative score of 1.88 and standard deviation of 3.04 as compared to the girl subgroup mean scores of .32 and standard deviation of .72. The critical value or "t" ratio was 2.29 which was significant at the .05 level of confidence. The observed difference was considered to be due to the ability of two of the boys who were able to perform the stunt to some degree or proficiency. Thus, the boy and girl subgroups were not equated for the forward handspring on the pre-test (see table 4, page 44.)

As a result of equating procedures and a test of significance on the pre-test, it was believed that the two groups were comparable at the beginning of the experimental period on three of the four possible pre-test stunts.

Table 2, page 43, includes the means, standard deviations and "t" ratios for the pre-test scores of judge one for the boy and girl subgroups. Table 3, page 46, includes the means, standard deviations and "t" ratios for the pre-test scores of judge two for the boy and girl subgroups. Table 4, page 44, includes the means, standard deviations and "t" ratios for the pre-test scores of both judges for the boy and girl subgroups.

TABLE 2

MEAN, STANDARD DEVIATION AND "t" RATIO FOR THE PRE-TEST SCORES
OF JUDGE ONE FOR BOYS AND GIRLS

Variable	N=8 Boys		N=22 Girls		"t"	p
	Mean	Standard Deviation	Mean	Standard Deviation		
Backward Roll Extension	3.75	1.91	2.64	2.82	1.03	N.S.
Squat Headstand	3.38	2.77	3.18	2.67	.17	N.S.
Handstand	.50	.93	.14	.35	1.59	N.S.
Forward Handspring	.75	1.17	.14	.35	2.26	≤.05

TABLE 3

MEAN, STANDARD DEVIATION AND "t" RATIO FOR THE PRE-TEST SCORES
OF JUDGE TWO FOR BOYS AND GIRLS

Variable	N=8 Boys		N=22 Girls		"t"	p
	Mean	Standard Deviation	Mean	Standard Deviation		
Backward Roll Extension	2.88	2.03	2.18	1.50	1.02	N.S.
Squat Headstand	3.13	3.14	2.55	2.37	.54	N.S.
Handstand	.50	.93	.14	.35	1.59	N.S.
Forward Handspring	1.13	1.89	.18	.40	2.28	≤.05

TABLE 4

MEAN, STANDARD DEVIATION AND "t" RATIOS FOR THE PRE-TEST SCORES
OF BOTH JUDGES FOR BOYS AND GIRLS

Variables	N=8 Boys		N=22 Girls		"t"	p
	Mean	Standard Deviation	Mean	Standard Deviation		
Backward Roll Extension	6.63	3.54	4.82	4.00	1.13	N.S.
Squat Headstand	6.50	5.83	5.73	4.97	.36	N.S.
Handstand	1.00	1.85	.27	.70	1.59	N.S.
Forward Handspring	1.88	3.04	.32	.72	2.29	≤.05

Results of the Within Group Comparisons
of the Pre-Test to Post-Test Scores

Table 5, page 45, includes the "t" ratios for the mean differences of the pre and post-test scores obtained from judge one for the boy subgroup. Table 6, page 45, includes the "t" ratios for the mean differences of the pre and post-test scores obtained from judge one for the girl subgroup. Table 7, page 46, includes the "t" ratios for the mean differences of the pre and post-test scores obtained from judge one for the boy and girl subgroups. Table 8, page 46, includes the "t" ratios for the mean differences of the pre and post-test scores obtained from judge two for the boy subgroup. Table 9, page 47, includes the "t" ratios for the mean differences of the pre and post-test scores obtained from judge two for the girl subgroup. Table 10, page 47, includes the "t" ratios for the mean differences

of the pre and post-test scores obtained from judge two for the boy and girl subgroup.

TABLE 5

"t" RATIOS FOR THE MEAN DIFFERENCES OF PRE AND POST-TEST SCORES OBTAINED FROM JUDGE ONE FOR THE BOY SUBGROUP

Variable	N=8 Differences Between Means	Standard Error of Difference	"t"	p
Backward Roll Extension	2.13	.79	2.69	≤ .05
Squat Headstand	2.38	.38	6.33	≤ .05
Handstand	0.0	.19	0.0	N.S.
Forward Handspring	2.38	.80	2.97	≤ .05

TABLE 6

"t" RATIOS FOR THE MEAN DIFFERENCES OF THE PRE AND POST-TEST SCORES OBTAINED FROM JUDGE ONE FOR THE GIRL SUBGROUP

Variable	N=22 Differences Between Means	Standard Error of Difference	"t"	p
Backward Roll Extension	0.96	.54	1.75	N.S.
Squat Headstand	2.36	.50	4.78	≤ .05
Handstand	.73	.22	3.31	≤ .05
Forward Handspring	1.91	.48	3.95	≤ .05

TABLE 7

"t" RATIOS FOR THE MEAN DIFFERENCES OF PRE AND POST-TEST SCORES
OBTAINED FROM JUDGE ONE FOR THE BOY AND GIRL SUBGROUPS

Variable	N=30 Differences Between Means	Standard Error of Difference	"t"	p
Backward Roll Extension	1.27	.46	2.79	≤.05
Squat Headstand	2.37	.37	6.35	≤.05
Handstand	.53	.18	3.00	≤.05
Forward Handspring	2.03	.41	4.98	≤.05

TABLE 8

"t" RATIOS FOR THE MEAN DIFFERENCES OF PRE AND POST-TEST SCORES
OBTAINED FROM JUDGE TWO FOR THE BOY SUBGROUP

Variable	N=8 Differences Between Means	Standard Error of Difference	"t"	p
Backward Roll Extension	2.75	.62	4.44	≤.05
Squat Headstand	1.63	.82	1.98	N.S.
Handstand	.12	.30	.42	N.S.
Forward Handspring	1.88	.90	2.10	≤.05

TABLE 9

"t" RATIOS FOR THE MEAN DIFFERENCES OF PRE AND POST-TEST SCORES
OBTAINED FROM JUDGE TWO FOR THE GIRL SUBGROUP

Variable	N=22 Differences Between Means	Standard Error of Difference	"t"	p
Backward Roll Extension	2.37	.43	5.51	≤ .05
Squat Headstand	2.27	.47	4.88	≤ .05
Handstand	.82	.29	2.81	≤ .05
Forward Handspring	1.82	.47	3.88	≤ .05

TABLE 10

"t" RATIOS FOR THE MEAN DIFFERENCES OF PRE AND POST-TEST SCORES
OBTAINED FROM JUDGE TWO FOR THE BOY AND GIRL SUBGROUPS

Variable	N=30 Differences Between Means	Standard Error of Differences	"t"	p
Backward Roll Extension	2.47	.35	7.02	≤ .05
Squat Headstand	2.10	.40	5.22	≤ .05
Handstand	.57	.24	2.38	≤ .05
Forward Handspring	1.84	.41	4.47	≤ .05

After the completion of the post-test, the "t" technique for testing the significance of the difference between the means was applied to the pre-test and post-test data of the boy and girl subgroups to provide the basis for a between group comparison. Both judges' ratings were summed together so that the scores from the data used in the discussion were out of a possible 20 points and were termed cumulative scores. The results were used to determine whether there were any significant changes in scores on the pre and post-test stunts as a result of the experimental period.

The boy subgroup had a mean difference of 4.86 for the backward roll extension between the pre-test and post-test scores for both judges. The cumulative score of both judges on the pre-test was 6.63 and the post-test mean was 11.50. The estimate of the sampling error of the mean difference was 1.27. This resulted in a critical ratio of 3.83 with seven degrees of freedom which indicated significance at the .05 level of confidence. The null hypothesis was rejected (see Table 11, page 49.)

The boy subgroup had a mean difference of 4.00 for the squat headstand between the pre-test and post-test scores for both judges. The cumulative score of both judges on the pre-test was 6.50 and the post-test mean was 10.50. The estimate of the sampling error of the mean difference was 1.17. This resulted in a critical ratio of 3.43 with seven degrees of freedom which indicated significance at the .05 level of confidence. The null hypothesis was rejected (see table 11, page 49.)

The boy subgroup had a mean difference of .13 for the handstand between the pre-test and the post-test scores for both judges.

The cumulative score of both judges on the pre-test was 1.00 and the post-test mean was .88. The estimate of the sampling error of the mean difference was .44. This resulted in a critical ratio of .28 with seven degrees of freedom which indicated no significance at the .05 level of confidence. The null hypothesis was accepted for this stunt for the boy subgroup (see table 11, page 49.)

The boy subgroup had a mean difference of 4.25 for the forward handspring between the pre-test and post-test scores for both judges. The cumulative score of both judges on the pre-test was 1.88 and the post-test mean was 6.13. The estimate of the sampling error of the mean difference was 1.61. This resulted in a critical ratio of 2.64 with seven degrees of freedom which indicated significance at the .05 level of confidence. The null hypothesis was rejected (see table 11, page 49.)

TABLE 11

"t" RATIOS FOR THE MEAN DIFFERENCES OF THE PRE AND POST-TEST SCORES OBTAINED FROM BOTH JUDGES FOR THE BOY SUBGROUP

Variable	N=8. Differences Between Means	Standard Error of Differences	"t"	p
Backward Roll Extension	4.86	1.27	3.83	≤ .05
Squat Headstand	4.00	1.17	3.43	≤ .05
Handstand	.13	.44	0.28	N.S.
Forward Handspring	4.25	1.61	2.64	≤ .05

The girl subgroup had a mean difference of 3.32 for the backward roll extension between the pre-test and post-test scores for both judges. The cumulative score of both judges on the pre-test was 4.82 and the post-test mean was 8.14. The estimate of the sampling error of the mean difference was .81. This resulted in a critical ratio of 4.09 with twenty-one degrees of freedom which indicated significance at the .05 level of confidence. The null hypothesis was rejected (see table 12, page 51.)

The girl subgroup had a mean difference of 4.64 for the squat headstand between the pre-test and the post-test scores for both judges. The cumulative scores of both judges on the pre-test was 5.73 and the post-test mean was 10.36. The estimate of the sampling error of the mean difference was .86. This resulted in a critical ratio of 5.38 with twenty-one degrees of freedom which indicated significance at the .05 level of confidence. The null hypothesis was rejected (see table 12, page 51.)

The girl subgroup had a mean difference of 1.55 for the handstand between the pre-test and post-test scores for both judges. The cumulative scores for both judges on the pre-test was .27 and the post-test mean was 1.82. The estimate of the sampling error of the mean difference was .48. This resulted in a critical ratio of 3.24 with twenty-one degrees of freedom which indicated significance at the .05 level of confidence. The null hypothesis was rejected (see table 12, page 51.)

The girl subgroup had a mean difference of 3.73 for the forward handspring between the pre-test and the post-test scores for

both judges. The cumulative scores for both judges on the pre-test was .32 and the post-test mean was 4.05. The estimate of the sampling error of the mean difference was .93. This resulted in a critical ratio of 4.00 with twenty-one degrees of freedom which indicated significance at the .05 level of confidence. The null hypothesis was rejected (see table 12, page 51.)

TABLE 12

"t" RATIOS FOR THE MEAN DIFFERENCES OF THE PRE AND POST-TEST SCORES OBTAINED FROM BOTH JUDGES FOR THE GIRL SUBGROUP

Variable	N=22 Differences Between Means	Standard Error of Differences	"t"	p
Backward Roll Extension	3.32	.81	4.09	≤ .05
Squat Headstand	4.64	.86	5.38	≤ .05
Handstand	1.55	.48	3.24	≤ .05
Forward Handspring	3.73	.93	4.00	≤ .05

When combined, the overall significantly superior post-test scores of both the boy and girl subgroups served to make the combined post-test scores even more significantly superior for all four of the stunts (see table 13, page 52.)

TABLE 13

"t" RATIOS FOR THE MEAN DIFFERENCES OF THE PRE AND POST-TEST SCORES
OBTAINED FROM BOTH JUDGES FOR THE BOY AND GIRL SUBGROUPS

Variable	N=30 Differences Between Means	Standard Error of Difference	"t"	p
Backward Roll Extension	3.73	.69	5.44	≤.05
Squat Headstand	4.47	.70	6.42	≤.05
Handstand	1.10	.39	2.82	≤.05
Forward Handspring	3.87	.793	4.87	≤.05

Results of the Boy, Girl, Between Group
Comparisons of the Post-Test

The "t" technique for testing the significance of the difference between the means was applied to the total of the judges' scores for the boy and girl subgroups of the experimental group on the post-test. The results were used to determine whether there was any significant difference between the boys and the girls on these four stunts upon completion of the experimental program.

On the post-test the boy subgroup had a judges' combined cumulative score of 11.50 and standard deviation of 2.67 for the backward roll extension as compared to the girl subgroups cumulative scores of 8.14 and standard deviation of 2.78. The critical ratio or "t" value was 2.96 which was significant at the .05 level of confidence. The null hypothesis was rejected (see table 16, page 55.)

For the squat headstand the boy subgroup had a judges' combined cumulative score of 10.50 and standard deviation of 5.68 as compared to the girl subgroups cumulative scores of 10.36 and standard deviation of 5.12. The critical value or "t" ratio was .06 which was not significant at the .05 level of confidence. The null hypothesis was retained (see table 16, page 55.)

For the handstand, the boy subgroup had a judges' combined cumulative score of .88 and standard deviation of 1.36 as compared to the girl subgroups cumulative scores of 1.82 and standard deviation of 2.32. The critical value or "t" ratio was 1.08 which was not significant at the .05 level of confidence. The null hypothesis was retained (see table 16, page 55.)

For the forward handspring the boy subgroup had a judges' combined cumulative score of 6.13 and a standard deviation of 4.80 as compared to the girl subgroups cumulative score of 4.05 and standard deviation of 4.62. The critical value or "t" ratio was 1.08 which was not significant at the .05 level of confidence. The null hypothesis was retained (see table 16, page 55.)

As a result of the between group comparison of the post-test results, it was believed that there was no significant difference between the two groups after the experimental period on three of the four post-test stunts.

Table 14, page 54, includes the means, standard deviations and "t" ratios for the post-test scores of judge one for the boy and girl subgroups. Table 15, page 54, includes the means, standard deviations and "t" ratios for the post-test scores of judge two for the boy and girl subgroups. Table 16 includes the means, standard

deviations and "t" ratios for the post-test scores of both judges for the boy and girl subgroups.

TABLE 14

MEAN, STANDARD DEVIATION AND "t" RATIO FOR THE POST-TEST SCORES OF JUDGE ONE FOR BOYS AND GIRLS

Variables	N=8 Boys		N=22 Girls		"t"	p
	Mean	Standard Deviation	Mean	Standard Deviation		
Backward Roll Extension	5.86	1.55	3.59	1.30	4.05	≤.05
Squat Headstand	5.75	2.44	5.55	2.24	.22	N.S.
Handstand	.50	.76	.86	1.13	.84	N.S.
Forward Handspring	3.13	2.53	2.05	2.36	1.09	N.S.

TABLE 15

MEAN, STANDARD DEVIATION AND "t" RATIO FOR THE POST-TEST SCORES OF JUDGE TWO FOR BOYS AND GIRLS

Variables	N=8 Boys		N=22 Girls		"t"	p
	Mean	Standard Deviation	Mean	Standard Deviation		
Backward Roll Extension	5.63	1.30	4.55	1.74	1.59	N.S.
Squat Headstand	4.75	3.33	4.82	3.07	0.05	N.S.
Handstand	.38	.74	.96	1.36	1.14	N.S.
Forward Handspring	3.00	2.39	2.00	2.35	1.03	N.S.

TABLE 16

MEAN, STANDARD DEVIATION AND "t" RATIOS FOR THE POST-TEST SCORES OF BOTH JUDGES FOR BOYS AND GIRLS

Variables	N=8 Boys		N=22 Girls		"t"	p
	Mean	Standard Deviation	Mean	Standard Deviation		
Backward Roll Extension	11.50	2.67	8.14	2.78	2.96	≤ .05
Squat Headstand	10.50	5.68	10.36	5.12	.06	N.S.
Handstand	.88	1.36	1.82	2.32	1.08	N.S.
Forward Handspring	6.13	4.80	4.05	4.62	1.08	N.S.

Results of the Stunts Tested Other Than Those in the Selection Test, Pre-Program Test or Post-Program Test

The subjects were not pre-tested on the two handed cartwheel due to the number of performers who had never tried the stunt before. All subjects were taught this stunt and were tested on it at the end of the experimental program. The mean score for both judges on the two handed cartwheel was 3.98. Judge one scored the group 4.13 and judge two scored the group 3.83.

From this point on, many other stunts were tested but were attempted only by those performers who could safely attempt them. For the front flip, eight of thirty attempted the stunt. The mean score for both judges for these eight performers was 5.18 with judge one scoring the group 5.36 and judge two scoring the group 5.00. This would indicate that 26.6 per cent of the experimental group

advanced sufficiently to try this stunt.

Six of the possible thirty subjects attempted one handed cart-wheels. The mean score of both judges for those six performers was 5.66 with judge one scoring the group 5.83 and judge two scoring the group 5.50. This indicates that 20 per cent of the experimental group advanced sufficiently to try this stunt.

Five of the possible thirty subjects tried the dive roll through a person's spread leg headstand. The mean score of both judges for these five performers was 5.10 with judge one scoring the group 5.20 and judge two scoring the group 5.00. This would indicate that 16.60 per cent of the experimental group advanced sufficiently to try this stunt.

Four of the possible thirty subjects attempted the dirty face roll. The mean score for both judges for these four performers was 5.37 with judge one scoring the group 6.00 and judge two scoring the group 4.75. This would indicate that 13.30 per cent of the experimental group advanced sufficiently to try this stunt.

Six of the possible thirty subjects attempted the combined series of stunts down the mat. The mean score of both judges for these six performers was 5.16 with judge one and two both scoring the performers with 5.16 mean scores. This would indicate that 20 per cent of the experimental group advanced sufficiently to try this stunt.

All of the thirty subjects attempted the thigh and chest doubles balances and had a degree of success in performing them. This could indicate that stunts of this nature might be fairly easily learned by a group of this caliber.

For the dive roll pyramid the best seven high dive rollers attempted the stunt and received mean ratings of 7.00 from both judges.

Three boys of the experimental group of thirty, attempted back handsprings and five girls of this same group attempted back walkovers. Both the boys and girls became fairly proficient in the stunts considering the limited time spent on learning them.

The whole group worked briefly on roundoffs but, due to the limited length of the program, were unable to advance sufficiently to merit a judges' rating.

At the completion of the program the judges rated the complete tumbling exhibition exercise routine. Judge one scored the group 7.50 and judge two scored the group 6.00. The mean total for both judges for the tumbling exhibition exercise routine was 6.75. This would indicate that the group was able to put all of the stunts they had learned throughout the program into a well disciplined timed routine with a certain degree of success.

CHAPTER IV

DISCUSSION

The issue of not challenging the more talented students in physical education classes in today's schools is becoming increasingly important. Tumbling and gymnastics, like many other physical education activities, falls easily into the category of teaching for mediocrity.

It was the prime purpose of this study to prove that a major portion of fifth and sixth grade children in a selected elementary school were capable of performing more advanced skills and stunts than they were being given the opportunity to learn. It was the writer's secondary hypothesis that a smaller proportion of sixth graders were capable of performing skills advanced enough to allow them to compete in gymnastic activities. A minor objective here was to single out those individuals and teach them skills appropriate to their ability level.

Selected items of the Iowa Revision of The Brace Test were used as a selection test to determine whether the fifth and sixth grade subjects being tested had tumbling and gymnastics potentialities. Once this test had been given, the subjects selected to take part in the experimental program were considered to be advanced for this grade level as concerned capability to learn more challenging gymnastic activities.

Of considerable importance is the fact that, at the time of the pre-test, no formal instruction had been given to the experimental group in advanced tumbling skills. At the time of the post-test, the subjects had been instructed for some two and one-half months.

After a comparison of scores for the back roll extension on the pre and post-tests, the investigator felt the stunt was mastered well enough so that it might be included in the fifth and sixth grade curriculum. Certainly most of the subjects in this program learned the skill without much difficulty. If there were any difficulty, it was experienced by some of the girls who were unable to push themselves up and hold the body weight on their arms. As might be anticipated, the girls who had the most trouble with the stunt were the fifth graders. This might indicate that perhaps fifth grade girls had slightly less arm strength than the sixth grade girls.

The squat headstand was the stunt on which the experimental group scored highest. It was also the easiest to learn. It appeared to the investigator that, at the fifth or sixth grade level, the subjects learned to do most of the balancing stunts easily. Therefore, it seemed that more balancing stunts could be included in the tumbling curriculum for late elementary grades.

The cartwheel was not included in the pre-test, but after working on it for awhile, the experimental group found it fairly easy to perform. It would found by the writer that, in most instances, the girls wanted to learn the stunt and the boys did not because the male subjects had the notion that a cartwheel was a girl's stunt. Another reason perhaps for this type of attitude on the part of the boys was that the girls had been exposed to this stunt earlier and that they

were far ahead of the boys when the skill was introduced. Further yet, the girls appeared to be slightly more agile and lighter on their feet than the boys and thus learned the stunt more quickly.

Of all stunts taught to the group, the handstand was the most difficult to master. Although the instructor did not concentrate on this particular stunt for any length of time, the subjects did show a degree of improvement in skill from the pre to the post-test. This would indicate that the stunt can be learned, but that it takes a considerable length of time before it can be mastered. Thus, it should be introduced at the fifth or sixth grade level so that the subjects have the required time needed to master the stunt while in school.

Twelve of the thirty performers mastered the front handspring and the remainder of the group approached proficiency on this stunt. The investigator felt that children of this age level were capable of mastering this stunt providing the proper lead up progression with a rolled up mat was used. Perhaps the major difficulty encountered by the subjects here was that of locking their elbows when supporting the body weight through the handstand position. Due to the later development of finger, hand, wrist, and arm strength as a part of the maturation process, the investigator allowed the subjects to perform the stunt with bent elbows. Most of the subjects performed the stunt well enough to hit their feet on the flat mat after going over the rolled up mat and thus prevent any injury.

From this point on in the program, the stunts became more advanced. The subjects were allowed to attempt the stunts if they so wished. Those learning the stunt quickly went to one mat and those who had trouble went to another. Anyone mastering the stunt while at

the slower performer's mat would quickly move up to the proficient performer's mat.

The front flip was mastered by five subjects but many others approached success in completing the stunt. It was of interest to note that, although the complete group of thirty people tried the stunt, and only five mastered it, the remaining twenty-five subjects still attempted to do it. Even more significant, not one injury occurred during all of this practice. The subjects seemed to be intrigued by this stunt and enjoyed performing it on the rolled up mats, even if success was not attainable on the flat mats.

The one handed cartwheel was a stunt mastered very well by six girls who put a series of them together down the length of the mats. Only the performers who had excellent mastery of the two handed cartwheel were encouraged to try this stunt. Again, as in the two handed cartwheels, the girls were much superior to the boys in learning and performing this stunt for the same reasons as previously mentioned.

Dive rolls were attempted by the entire group. The stunt was attempted first from a standing position and then from a running two foot take off. After proficiency was attained, the performers were allowed to dive over one person who was on the mats in a crouched position on hands and knees. When everyone had mastered this stunt, the students were encouraged to try to dive over two people in the crouch position. Those successful individuals were then challenged by a new stunt. They were allowed to dive between a person's legs who was in a spread leg headstand position. Of these people, the seven best were chosen to perform the dive roll pyramid in the routine.

In all instances, the subjects were not forced to perform these stunts unless they wanted to do so. With the dive rolls and many other routine stunts, timing was stressed so that the subjects would go quickly one after another and not collide.

The dirty face roll was a stunt attempted by the complete group but mastered only by the exceptional few. Perhaps it was not mastered because there was insufficient time to devote to its practice. In the lead up progression, the subjects had trouble carrying the body weight on the arms and cushioning themselves into the mat on the chest and stomach. After the initial fear was lost, skill was attained rapidly. This stunt is one which should be included at the fifth or sixth grade level because it teaches the performer body control by landing on his chest cushioning the impact by carrying the body weight on his arms. It is also an excellent stunt for coordination and flexibility.

As the experimental program drew to an end, the writer selected the seven best performers of the total program and had them put together a series of stunts down the length of four mats. In essence, this was the beginning of a competitive gymnastic tumbling routine. These performers put together excellent combinations of handsprings, necksprings, headsprings, front flips, cartwheels and dive rolls to make an effective trip down the mats. The investigator felt that more subjects were capable of putting these stunts together into a routine, but the limited time did not permit them to try.

The thigh and chest balances were performed with a great deal of success. There were few people in the program who had trouble doing these stunts. Perhaps this would indicate that this type of stunt could be stressed more at the elementary level.

As mentioned previously, the dive roll pyramid consisted of the seven best high dive rollers. The investigator felt it was quite important to discourage higher dives than their capabilities indicated at this time. This aided in the elimination of possible injury. This stunt was enjoyed most by the subjects. Even those who did not attempt to do it enjoyed watching the performance of others. The writer felt that this stunt could be attempted at any level if the students were sufficiently skilled to do high dive rolls.

On brief occasions, certain individuals were chosen to work on back handsprings and back walkover handsprings. The work done on these stunts was limited. However, the students who attempted them seemed to learn quickly.

Due to greater flexibility at this time, five girls were chosen to attempt back walkover handsprings. These girls apparently had little trouble in bending backward, placing their hands on the floor and kicking over. The investigator felt that, had time permitted, these five girls, and perhaps more, would have eventually been capable of doing a series of these stunts down the length of the mats.

Three boys attempted back handsprings and were selected because of their ability to lock their elbows and carry their body weight on their arms. The degree of proficiency attained for this stunt was excellent, especially when one considered the length of time the stunt had been practiced. Hand spotting was given by the instructor for both the back walkover handspring and back handspring.

The tumbling routine was meant to climax and be a finale for the complete program. It also served to motivate the students to do their very best. All the stunts or drills used in the routine were

to be done quickly so that there was no lapse of time in the routine from one stunt to the next. Every person in the experimental program participated in the routine. Each took part in at least half of all the stunts learned. The subjects were eager to be selected and practiced as much as they could. They learned to work with speed and precision since the routine would last only twenty minutes.

The tumbling exercise exhibition was performed for the rest of the school on the last day of the experimental program. The performers were both excited and enthusiastic about their performance before a large audience. The complete exhibition went off flawlessly much to the enjoyment of the audience and the performers.

There was much consultation and discussion by the investigator with the school administration over taking the experimental group other places outside of the school to perform this exhibition. It was decided because of the liability factors in transporting these children from place to place, that no such outside performance would be made.

The investigator felt that it was a shame to end the program without performing in other places because the subjects had worked long and hard to attain the proficiency they had to that date. It seems to the investigator that some type of future planning should be made to provide transportation in the form of buses for such activities.

A description of the tumbling exercise exhibition, in sequence of stunts as they occurred, can be found in Appendix C.

Upon reflection, the investigator felt that much was accomplished in the area of learning advanced tumbling skills on the part of elementary school performers. The experimental group, as a whole,

learned many new skills in the area of advanced stunts and tumbling. This was shown by the increase in scores from the pre to the post-test. In every instance, the judges scored a considerable increase from the pre to the post-test.

The investigator felt that any improvement made as a result of this study was on an individual basis. Each and every subject in the experimental program had the exact same opportunity to improve in skill as the next subject. The investigator found, however, that a considerable number of different skill levels arose even though the complete group was classified as above average at the beginning of the program. Some performers attained only slight increases in the degree of skill reached. Others discovered they were far more skilled in such specific areas as balance. A few reached a much higher skill level in all areas. They were surprised at their own capabilities and the skills they developed.

There was a significant difference on the pre-test for the forward handspring for the boy subgroup over the girl subgroup. This was obviously due to the background some of these boys might have had out of school in learning this stunt. The post-test scores indicate no significant difference between these same two groups for the forward handspring which would indicate that the girls, after instruction, could do the stunt equally as well as the boys.

There was a significant difference for the boy subgroup over the girl subgroup on the post-test for the backward roll extension. The groups were equal on the pre-test. This would indicate that the boys learned the stunt better than the girls after instruction. The investigator felt that the difference here was a result of the greater

arm strength of the boys. Even at the fifth and sixth grade levels, this difference was becoming evident. The boys throughout this program had less trouble supporting their body weight than did the girls.

Throughout this study, the investigator found that the girls were more adept at learning such things as one and two handed cartwheels, backbends and back walkover handsprings. These stunts required far more flexibility and whip action in the trunk area. Girls of this age group seemed to possess more flexibility than the boys.

On the other hand, the boys seemed superior to the girls in learning such things as forward handsprings, headsprings and backward handsprings. These stunts required strength and ability to lock the elbows and support the body weight on the hands and arms.

It does seem that the investigator had a select group of six or seven performers who were capable of becoming competitive gymnasts. This group reached a level of proficiency not attained by the remaining experimental group members. Will highly talented children be hurt by the lack of challenge in many elementary physical education programs?

It was a pleasure to observe the experimental group take newly acquired skills and place them together into a set routine. As a result of the judges rating scores on the final routine, it could be said that youngsters of this age group are capable of learning refined skills set in a rigid formal type of timed routine or exercise.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of this study was to determine whether certain fifth or sixth grade children were capable of increasing tumbling and gymnastic skills through participation in an advanced gymnastic program. The writer also attempted to determine whether or not the children could develop these newly acquired skills and stunts into a precision timed tumbling exhibition routine.

The program began by the administration of eight selected stunts of the Iowa Revision of The Brace Test which were to determine those people with gymnastic aptitudes. The test was administered by a panel of expert gymnastic judges and was scored on a pass or fail basis. Two trials were given for each stunt and the subjects were given a pass for the stunt if they passed it on either trial. The subjects had to pass four of the eight tests to be admitted into the experimental program. Of the 48 subjects tested, 30 were chosen for the experimental program.

The experimental group was given a pre-test over four selected intermediate stunts. The subjects were then put through a two and one-half month experimental instructional program and tested again at the end on the same four stunts and the scores compared. Additional tests

were given over the stunts learned during the program that had not been included on the pre or post-tests.

The null hypothesis was assumed for this study and the "t" technique for testing the significance of the difference between the means derived from correlated scores from small samples was used to make a within group comparison of pre-test scores to post-test scores.

Comparisons were then made between the boy and girl subgroups of the experimental group to establish whether or not the differences in performance were of a significant nature. For this purpose the "t" technique for testing the significance of the difference between the means was used. This test determines the ratio between the mean difference and sampling error of the difference.

Conclusions

The following conclusions were believed justified by the analysis of the data obtained in this study:

1. The experimental group showed significant improvement in all of the selected stunts during the experimental period at the criterion .05 level.

2. The girl subgroup was not significantly different from the boy subgroup before the experimental program began and was not significantly different when the experimental program ended. Thus, it might be concluded that both groups were capable of and did perform the same skills.

3. Selected fifth and sixth grade children are capable of performing a precision timed exhibition routine using the advanced tumbling skills learned during an experimental program.

Recommendations

The following recommendations were made as a result of this study:

1. That a follow-up study be made on the same subjects from this experimental program to see what skills they will be taught in junior high school and whether any further advancement or progression will be made.

2. That a study be made to determine the areas in which girls and boys differ from one another in tumbling at the elementary level and which stunts would be best for each group at each grade level.

3. That a study be conducted on present competitive tumblers and gymnasts in an attempt to determine the elementary school background in which they were developed.

4. That a study be made evaluating tumbling and self-testing activities as a part of the physical education curriculum and, as a result, developing a curriculum which has excellent skill progression from the first through the sixth grades.

5. That a study be made on self-testing activities intramurally at the elementary school level to help develop an extra curricular program whereby all levels of skills can be further developed.

APPENDIX A

THE PRE AND POST-TEST ITEM SCORES OF BOTH JUDGES FOR EACH MEMBER
OF THE EXPERIMENTAL GROUP SCORED ON A 10 POINT BASIS

Subjects		Backward Roll		Squat		Handstand		Forward	
		Extension		Headstand				Handspring	
		pre	post	pre	post	pre	post	pre	post
1	Judge 1	5	5	4	5	0	1	0	0
	Judge 2	4	6	4	2	0	1	0	0
2	Judge 1	3	4	1	3	0	0	0	1
	Judge 2	5	5	0	1	0	0	0	3
3	Judge 1	6	8	6	8	2	1	1	4
	Judge 2	6	7	8	8	2	0	1	4
4	Judge 1	0	7	1	5	0	0	0	5
	Judge 2	0	5	0	4	0	0	0	5
5	Judge 1	3	5	5	7	2	2	2	3
	Judge 2	2	5	4	6	2	2	3	1
6	Judge 1	5	5	1	3	0	0	0	0
	Judge 2	1	4	1	1	0	0	0	0
7	Judge 1	5	8	8	10	0	1	3	6
	Judge 2	3	8	7	10	0	0	5	6
8	Judge 1	3	5	1	5	0	0	0	6
	Judge 2	2	5	1	6	0	0	0	5
9	Judge 1	2	6	7	9	0	0	0	5
	Judge 2	2	7	6	9	0	0	0	4
10	Judge 1	4	4	2	6	0	1	0	1
	Judge 2	4	5	1	7	0	1	0	1
11	Judge 1	5	7	8	7	1	1	0	7
	Judge 2	5	6	8	9	1	1	0	7
12	Judge 1	3	2	4	6	0	0	0	1
	Judge 2	3	3	4	5	0	0	0	0
13	Judge 1	2	4	0	4	0	0	0	0
	Judge 2	2	6	0	3	0	0	0	0
14	Judge 1	3	4	0	2	0	0	0	1
	Judge 2	1	5	0	1	0	0	0	1

THE PRE AND POST-TEST ITEM SCORES OF BOTH JUDGES FOR EACH MEMBER
OF THE EXPERIMENTAL GROUP SCORED ON A 10 POINT BASIS

Subjects		Backward Roll		Squat		Handstand		Forward	
		Extension		Headstand		Handstand		Handspring	
		pre	post	pre	post	pre	post	pre	post
15	Judge 1	3	4	7	4	0	4	1	1
	Judge 2	2	6	4	3	0	5	1	0
16	Judge 1	2	4	1	3	0	0	0	1
	Judge 2	2	5	1	1	0	0	0	0
17	Judge 1	4	5	6	7	0	1	1	5
	Judge 2	5	6	4	8	0	4	1	6
18	Judge 1	2	3	1	3	0	0	0	2
	Judge 2	2	4	0	2	0	0	0	4
19	Judge 1	2	3	2	3	0	2	0	1
	Judge 2	2	4	1	2	0	2	0	2
20	Judge 1	1	3	1	4	0	1	0	0
	Judge 2	2	2	2	2	0	1	0	1
21	Judge 1	3	5	4	8	0	1	0	6
	Judge 2	4	6	4	9	0	0	0	4
22	Judge 1	0	2	7	7	1	2	0	1
	Judge 2	0	1	6	8	1	1	0	1
23	Judge 1	2	2	1	8	0	0	0	1
	Judge 2	2	5	0	7	0	0	0	1
24	Judge 1	3	3	1	3	1	3	0	0
	Judge 2	2	4	1	3	1	2	0	1
25	Judge 1	0	3	5	8	0	1	0	0
	Judge 2	0	3	4	8	0	1	0	0
26	Judge 1	1	3	1	2	0	0	0	0
	Judge 2	1	2	0	1	0	0	0	0
27	Judge 1	2	3	4	7	0	0	0	1
	Judge 2	2	5	3	6	0	0	0	0

THE PRE AND POST-TEST ITEM SCORES OF BOTH JUDGES FOR EACH MEMBER
OF THE EXPERIMENTAL GROUP SCORED ON A 10 POINT BASIS

Subjects		Backward Roll		Squat		Handstand		Forward	
		Extension		Headstand				Handspring	
		pre	post	pre	post	pre	post	pre	post
28	Judge 1	2	2	1	8	0	2	0	0
	Judge 2	2	4	1	6	0	1	0	0
29	Judge 1	2	3	6	7	0	0	1	6
	Judge 2	4	3	5	6	0	0	1	6
30	Judge 1	0	4	1	6	0	0	0	5
	Judge 2	0	4	1	8	0	2	1	5

APPENDIX B

OTHER POST-TEST SCORES OF BOTH JUDGES FOR ITEMS NOT INCLUDED IN
THE ORIGINAL FOUR STUNTS OF THE PRE AND POST-TEST

Subjects		Two Handed Cartwheel	One Handed Cartwheel	Front Flip	Dive Rolls	Dirty Face Rolls	Series of Stunts	Back Hand Springs	Back Walkovers	Thigh Balance	Pyramid	Routine
1	Judge 1	5								8		
	Judge 2	6								7		
2	Judge 1	4										
	Judge 2	4										
3	Judge 1	4		7	5		5			9		
	Judge 2	3		7	3		3			8		
4	Judge 1	5								1		
	Judge 2	3								1		
5	Judge 1	6		4		6	5	1		9		
	Judge 2	5		5		3	4	0		8		
6	Judge 1									5		
	Judge 2	1								3		
7	Judge 1	7		8	4		4	4		8		
	Judge 2	7		8	6		5	3		9		
8	Judge 1	2		4		9				10		
	Judge 2	3		3		8				8		
9	Judge 1	7	3	3		5	6		1	1		
	Judge 2	6	3	3		4	6			4		
10	Judge 1	2								4		
	Judge 2	2								4		
11	Judge 1	5		4					2	4		
	Judge 2	3		2					2	4		
12	Judge 1	1								6		
	Judge 2	0								8		

OTHER POST-TEST SCORES OF BOTH JUDGES FOR ITEMS NOT INCLUDED IN
THE ORIGINAL FOUR STUNTS OF THE PRE AND POST-TEST

Subjects		Two Handed Cartwheel	One Handed Cartwheel	Front Flip	Dive Rolls	Dirty Face Rolls	Series of Stunts	Back Hand Springs	Back Walkovers	Thigh Balance	Pyramid	Routine
13	Judge 1	3								7		
	Judge 2	2								7		
14	Judge 1	7								5		
	Judge 2	5								6		
15	Judge 1	6			5					3		
	Judge 2	6			6					4		
16	Judge 1	4			5					3		
	Judge 2	4			4					3		
17	Judge 1	8	6	7			7		9			
	Judge 2	9	7	6			7		7			
18	Judge 1	2	5							7		
	Judge 2	2	4							8		
19	Judge 1	2										
	Judge 2	4										
20	Judge 1	4										
	Judge 2	4										
21	Judge 1	8	10		6					8		
	Judge 2	6	10		6					9		
22	Judge 1	3										
	Judge 2	3										
23	Judge 1	4										
	Judge 2	5										
24	Judge 1	4								4		
	Judge 2	3								5		

OTHER POST-TEST SCORES OF BOTH JUDGES FOR ITEMS NOT INCLUDED IN
THE ORIGINAL FOUR STUNTS OF THE PRE AND POST-TEST

Subjects		Two Handed Cartwheel	One Handed Cartwheel	Front Flip	Dive Rolls	Dirty Face Rolls	Series of Stunts	Back Hand Springs	Back Walkovers	Thigh Balance	Pyramid	Routine
25	Judge 1	2										
	Judge 2	3										
26	Judge 1	4	7	6						8		
	Judge 2	4	4	6						7		
27	Judge 1	2								6		
	Judge 2	2								7		
28	Judge 1	5										
	Judge 2	3										
29	Judge 1	4				4			0	8		
	Judge 2	3				4			1	6		
30	Judge 1	4	4				4		4	7		
	Judge 2	4	5				4		3	8		
Total - Judge 1											7	7.5
Group Judge 2											7	6.0
Ratings												

APPENDIX C

DATES OF EXPERIMENTAL PROGRAM

Program started - October 19, 1966

October 24, 1966

October 27, 1966

October 28, 1966

October 31, 1966

November 3, 1966

November 4, 1966

November 7, 1966

November 10, 1966

November 11, 1966

November 14, 1966

November 17, 1966

November 18, 1966

November 21, 1966

November 24, 1966

November 25, 1966

November 28, 1966

December 1, 1966

December 2, 1966

December 5, 1966

December 8, 1966

December 9, 1966

December 12, 1966

December 15, 1966

Program finished -December 16, 1966

BEN FRANKLIN EXHIBITION TUMBLING ROUTINE

1. Cross rolling
2. Backward rolls
3. Backward roll extension
4. Headstand
5. Cartwheels
6. Handsprings
7. Pig walk
8. Caterpillar walk
9. Front flips
10. Dive rolls through spread leg handstand
11. Dirty face rolls
12. Peanut shuffle
13. Series of stunts down the length of the mats
14. Doubles balance
15. Pyramid

BEN FRANKLIN ELEMENTARY SCHOOL

Dear Parents,

We are pleased to inform you that your child has been selected to participate in a voluntary tumbling program, which is to be conducted at the school from now until the middle of December. The activity periods will take place on Mondays and Fridays, during the noon hour, on Thursday afternoon from 3:30-4:30 P.M.

This program is in no way compulsory, but could benefit your child in the following ways:

1. Increase strength
2. Improve coordination
3. Improve agility
4. Increase flexibility
5. Gain balance
6. Have carry over values, pertaining to other sports and activities

Mr. Wilson, the regular physical education teacher, and his student teacher, Mr. Pickard, will assist in supervision.

We hope that this group will be able to perform their routine at such functions, as the P.T.A.

If you agree to allow your child to participate in this program, would you please fill in the blank below and return it to the school with your child.

Thank you for your consideration.

Sincerely yours,

Gordon Longmuir
Graduate Teaching Assistant
University of North Dakota

I, Mr./Mrs. _____, agree to allow my child to participate in tumbling program being conducted at Benjamin Franklin Elementary School.

Date: October 27, 1966

This program has been approved by the local School Administration.

L. D. EMERSON, PRINCIPAL

The writer wishes to express thanks to the following students
for their participation in this study:

<u>Subject Number</u>	<u>Initial</u>
1	L. S.
2	P. G.
3	K. D.
4	T. E.
5	D. B.
6	R. V.
7	M. J.
8	K. L.
9	P. L.
10	V. I.
11	J. F.
12	D. C.
13	P. M.
14	C. J.
15	D. W.
16	D. K.
17	B. C.
18	C. A.
19	M. H.
20	K. T.
21	W. O.
22	M. T.
23	K. G.
24	T. W.
25	M. S.
26	T. N.
27	C. I.
28	K. H.
29	L. S.
30	N. H.

THE SCORING SYSTEM USED BY THE JUDGES IN THIS STUDY ON ALL
TESTS EXCEPT THE SELECTION TEST

In scoring A.A.U. and intercollegiate competition, the judges shall award scores on the basis of 0 to 10 points with fractions of tenths of a point showing in the majority of cases.

Difficulty	3.4 points
Composition	1.6 points
Execution	<u>5.0 points</u>
Total	10.0 points

BIBLIOGRAPHY

Books

- Burns, Ted and Miculeau, Tyler. Tumbling Techniques Illustrated. New York: The Ronald Press Co., 1957.
- Fait, Hollis F. Physical Education for the Elementary School Child. Philadelphia: W. B. Saunders Co., 1964.
- Garrett, Henry E. Statistics in Psychology and Education. New York: Longmans, Green and Co., 1958.
- Johnson, Barry L. A Beginner's Book of Gymnastics. New York: Appleton - Century Crofts, Inc., 1966.
- Keeney, Charles J. Fundamental Tumbling Skills Illustrated. New York: The Ronald Press Co., 1966.
- LaSalle, Dorothy. Guidance of Children through Physical Education. New York: A. S. Barnes and Co., 1964.
- Loken, Newton C. and Willoughby, Robert J. A Complete Book of Gymnastics. Englewood Cliffs, N. J.: Prentice Hall Inc., 1959.
- McCloy, Charles Harold and Young, Norma Dorothy. Tests and Measurements in Health and Physical Education. New York: Appleton - Century Crofts, Inc., Third Edition, 1954.
- McNemar, Quinn. Psychological Statistics. New York: John Wiley and Sons, Inc., 1949.
- Miller, Arthur G. and Whitcomb, Virginia. Physical Education in the Elementary School Curriculum. Englewood Cliffs, N. J.: Prentice Hall, Inc., 1957.
- Neilson, N. P. and Van Hagen, Winifred. Physical Education for Elementary Schools. New York: The Ronald Press Co., 1956.
- O'Keefe, Patric Ruth and Aldrich, Anita. Education through Physical Activities. St. Louis: The C. V. Mosley Co., 1959.
- Price, Hartly D., Keeney, Charles, Giallombardo, Joseph and Phillips, Chester W. Gymnastics and Tumbling. Menasha, Wisconsin: The George Banta Company Inc., 1961.

Rogers, Martin. A Handbook of Stunts. New York: The MacMillan Company, 1936.

Vannier, Maryhelen and Foster, Mildred. Teaching Physical Education in Elementary Schools. Philadelphia: W. B. Saunders Co., 1954.

Physical Education Guide for Elementary Schools. State of North Dakota, Department of Public Instruction, Bismarck, North Dakota, 1960.

Articles and Periodicals

Nagel, Charles. "A Stunt Play Program for Children," Journal of Health, Physical Education and Recreation, (May 1952), 29-30.

Narowitz, Janet, Leso, Ami, Vodola, Tom, Hellman, Bill and Piscope, John. "Gymnastics," Journal of Health, Physical Education and Recreation, Vol. 35, No. 8, (October 1964), 21.

Parry, Kenneth R. "The Learning Process in Tumbling for the Elementary Grades," Research Quarterly, Vol. 21, No. 2, (May 1950).

Unpublished Material

Davis, Rex S. "Placement of Selected Tumbling and Balance Stunts in the Elementary School Physical Education Program." Unpublished Master's Thesis, Washington State University, 1961.

Hill, Rose M. "Educational Gymnastics for the Teacher of Physical Education." Unpublished Master's Thesis, University of Iowa, 1962.

Wickstrom, Ralph L. "A Comparative Study of the Methodologies for Teaching Gymnastics and Tumbling." Unpublished Master's Thesis, University of Iowa, 1952.