

A STUDY OF THE EFFECTIVENESS OF THE ONE HAND
AND THE TWO HAND UNDERHAND FREE THROW SHOT
IN BASKETBALL

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Date *July 18, 1952*

A Thesis submitted to the Faculty of the Graduate
School of the University of Colorado in partial
fulfillment of the requirements for the Degree

Master of Science

Department of Physical Education

1952

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A Study of the Effectiveness of the One Hand and the Two Hand
Underhand Free Throw Shot in Basketball

Thesis directed by Associate Professor Frank B. Prentup

This Thesis for the M.S. degree by

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has been approved for the
Department of
Physical Education

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younger, who had had no previous high school varsity experience
or coaching in basketball. The subjects were equated into
two comparable groups. Group I was taught the one hand push free
throw method and Group II was taught the two hand underhand free
throw shot method. The entire teaching and testing time for each
group covered a period of nine weeks. Three days of the first
week were used for preliminary shooting and two days were used for the initial free throw shooting test.
Eight weeks, five days a week, were used for instruction and
practicing free throw shooting. A final free throw shooting
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The problem of this study was that of determining whether the one hand "push" shot or the two hand underhand method of teaching free throw shooting was the more effective under conditions set up in this study.

In the fall of 1951 forty boys twenty years of age or younger, who had had no previous high school varsity experience or coaching in basketball or free throw shooting were equated into two comparable groups. Group I was taught the one hand push free throw method and Group II was taught the two hand underhand free throw shot method. The entire teaching and testing time for each group covered a period of nine weeks. Three days of the first week were used for preliminary testing of general athletic ability and two days were used for the initial free throw shooting test. Eight weeks, five days a week, were used for instruction and practicing free throw shooting. A final free throw shooting test was given the last day that the groups met.

The results of this study showed that the mean improvement in shooting for the one hand group was 11.1 and for the two hand group was 15.7. The standard error of the difference between the two means was found to be 2.31. The actual difference between the

two means was 4.6. "t" equalled 2.0, this difference was significant at the 5 per cent level. We need therefore conclude that in this study the two hand underhand shot group was significantly superior to the one hand push shot group.

This abstract of about 250 words is approved as to form and content. I recommend its publication.

Signed

Frank B. Pentup
Instructor in charge of dissertation

CHAPTER	PAGE
I. INTRODUCTION	1
Statement of the problem	1
Need for the study	2
Limitations of the study	4
Brief statement of the procedure	5
Review of remaining parts of thesis	6
II. REVIEW OF RELATED LITERATURE	7
III. PROCEDURE	14
Selection of two experimental groups	14
Administration of a general athletic ability test given to the groups	15
Teaching procedure for the one-hand shot	23
Teaching procedure for the two-hand underhand shot	24
IV. ANALYSIS AND INTERPRETATION OF DATA	30
Treatment of the data	30
Analysis of the data	30
V. SUMMARY AND CONCLUSIONS	35
Recommendations	36
BIBLIOGRAPHY	37

TABLE OF CONTENTS

CHAPTER	PAGE
I. INTRODUCTION	1
Statement of the problem	1
Need for the study	2
Limitations of the study	4
Brief statement of the procedure	5
Review of remainder of thesis	6
II. REVIEW OF RELATED LITERATURE	7
III. PROCEDURE	14
Selection of two experimental groups	14
Administration of a general athletic ability test given to the groups	15
Teaching procedure for the one-hand shot	23
Teaching procedure for the two-hand underhand shot	24
IV. ANALYSIS AND INTERPRETATION OF DATA	30
Treatment of the data	30
Analysis of the data	30
V. SUMMARY AND CONCLUSIONS	35
Recommendations	36
BIBLIOGRAPHY	37
Shooting due to training and how each Subject varied from the Mean	33
Actual gain or progress made by Group II in Shooting due to training and how each subject varied from the Mean	34

CHAPTER I

LIST OF TABLES

TABLE	PAGE
I. "T" Scores made by Group I in the Athletic Ability Test	19
II. "T" Scores made by Group II in the Athletic Ability Test	20
III. Scores made by Group I in the Initial Foul Shooting Test	21
IV. Scores made by Group II in the Initial Foul Shooting Test	22
V. Computation of Standard Deviation of Motor Skills	26
VI. Computation of Standard Deviation of Motor Skills	27
VII. Scores and actual gain made by Group I in the Final Foul Shooting Test over the Initial Foul Shooting Test	28
VIII. Scores and actual gain made by Group II in the Final Foul Shooting Test over the Initial Foul Shooting Test	29
IX. Actual gain or progress made by Group I in Shooting due to training and how each Subject varied from the Mean	33
X. Actual gain or progress made by Group II in Shooting due to training and how each subject varied from the Mean	34

CHAPTER I

INTRODUCTION

In the last few years a difference of opinion has developed regarding the relative effectiveness of the different styles of free throw shooting. As a result of observing different styles of free throw shooting over a period of years the experimenter became interested in determining which of the two most popular methods would be more effective in teaching beginners.

The two methods of teaching free throw shooting compared in this study were the one hand "push" shot method and the two hand underhand method. These two methods were chosen because, there has recently been considerable controversy over the comparative effectiveness of these two styles of shooting. Many opinions have been expressed but very little experimental work has been done on the relative merits of the different styles of free throw shooting.

THE STATEMENT OF THE PROBLEM

It was the purpose of this study to determine whether the one hand "push" free throw method or the two hand "underhand" free throw method is the more effective.

When the original rules for the game of basketball¹ were formulated the penalty for an infraction of a rule was to dismiss the

¹ J. Naismith, Basketball, Its Origin and Development. New York: Association Press, 1941. pp. 61-86.

player from further fouling until another score had been made. This rule did not protect a team that did very

Free throw shooting has long been stressed as an important phase of basketball. In spite, however, of the rather general recognition by coaches of the importance of free throw shooting, comparatively little has been done to improve free throw percentages. It should be kept in mind that the free throw is one type of shot that counted only one point. Realizing that this penalty was that is exactly the same under game conditions as in practice, as the value of a field goal was changed from one to three far as the actual physical performance is concerned. Accurate free throw shooting is a vital factor in close games, in which the winning or losing may be in the number or percentage of the free shots made.

Many championships have been won or lost on the free throw line. Good free throw shooting is a great stabilizing influence in the game of basketball in that the ability to convert a high percentage of free throw opportunities will keep that team in the game when they are "off" in their shooting from the field. Good free throw shooting will also discourage fouling by the opposition, which in turn should help the offense operate more effectively. On the other hand, a team that is fouled by the opposition and fails to convert the subsequent free throws may encourage the opposition to continue fouling.

When the free throw was first introduced it was with the idea that very few of the shots would be made and that the value of a converted free throw would depend on the skill of the team that was shooting. This resulted in one player designated by his team to make the free throw.

When the original rules for the game of basketball¹ were formulated the penalty for an infraction of a rule was to dismiss the player from the game. This again made the foul

¹ J. Naismith, Basketball, Its Origin and Development. New York: Association Press, 1941. pp. 61-86.

player from further action after his second foul until another score had been made. This rule did not protect a team that did very little fouling so a clause was inserted in the rules which stated that when three fouls were committed by one team without the opposing team committing a foul, the team that was fouled should receive one point. This was rather a serious penalty, as a field goal at that time counted only one point. Realizing that this penalty was too severe, the value of a field goal was changed from one to three points, and each foul committed against a team counted one point. This resulted in too many free points so the next change allowed the team that had been fouled to try for the basket from a line twenty feet from the goal. If this try was successful the goal counted the same as one made from the field. Later the free throw line was moved up to fifteen feet and all successful goals counted the same as goals from the field. Shortly after this the points were changed to one for a free throw and two for a field goal. The distance of the free throw line and the value of the basket have remained the same up until the present time.

Length When the free throw was first introduced it was with the idea that very few of the shots would be made and that the value of a foul would depend on the skill of the team that was shooting. This resulted in one player designated by his team to make the free throw. This player soon became so expert that he could throw the ball into the basket a large percentage of the time. This again made the foul practically as good as a goal from the field and resulted in the rule to give each offended player a free toss when fouled. This was

an excellent change as it has made it necessary for every member of the team to develop skill at and to become adept at free throw shooting.

A brief description of the procedure used in this experiment follows: In the fall of 1951 forty boys twenty years of age or younger, who had had no previous high school varsity experience or coaching in basketball or free throw shooting were equated into committed during the last three minutes of every game, an adept comparable groups. Group I was taught the one hand push free throw free throw shooting team will be at a great advantage.

method and Group II was taught the two hand underhand free throw shot method. The LIMITATIONS OF THE STUDY

being time for each group covered a period of nine weeks. Each subject was instructed daily

Subjects

and practiced twenty-five shots a day for a period of eight weeks, Only two experimental groups were taught free throw shooting. five days a week, for a total of forty days with each subject The only stipulation for participation in the experiment was that practicing approximately one thousand shots in his particular each subject be twenty years of age or younger and that he had had method.

no previous high school varsity experience or coaching in basketball One week was used for preliminary testing. Of this, three or free throw shooting.

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Number of methods

periods were used for free throw shooting. Each subject attempted This study was limited to only the two methods of teaching one hundred free throw shots using the one hand push or the free throw shooting.

first day and one hundred attempts with the two hand underhand

Length of teaching periods and number of lessons

shot the second day. The results of this preliminary testing were There were five periods of preliminary testing, forty class used to aid in equating the groups. During the last meeting of periods of instruction and practice, and one period for final each group the subjects were given a final free throw shooting testing. The free throw shooting practice periods were held five test. This final test consisted of shooting one hundred shots in days a week for eight weeks. Each subject practiced twenty five the subject's practiced method. shots a day.

BRIEF STATEMENT OF THE PROCEDURE

A brief description of the procedure used in this experiment follows: In the fall of 1951 forty boys twenty years of age or younger, who had had no previous high school varsity experience or coaching in basketball or free throw shooting were equated into comparable groups. Group I was taught the one hand push free throw method and Group II was taught the two hand underhand free throw shot method. The entire teaching and testing time for each group covered a period of nine weeks. Each subject was instructed daily and practiced twenty-five shots a day for a period of eight weeks, five days a week, for a total of forty days with each subject practicing approximately one thousand shots in his particular method.

One week was used for preliminary testing. Of this, three periods were used for testing general athletic ability and two periods were used for free throw shooting. Each subject attempted one hundred free throw shots using the one hand push method the first day and one hundred attempts with the two hand underhand shot the second day. The results of this preliminary testing were used to aid in equating the groups. During the last meeting of each group the subjects were given a final free throw shooting test. This final test consisted of shooting one hundred shots in the subject's practiced method.

REVIEW OF REMAINDER OF THESIS

Chapter II is devoted to a review of the literature on free throw shooting in basketball as presented by the outstanding authorities on the subject.

A description of the groups studied, the administration of the tests involved, the teaching procedure for the two methods of shooting and the selection of the groups are included in Chapter III.

Chapter IV deals with the treatment of the data and the analysis of the results of the experiment.

The summary and conclusions based on the findings in this study with the recommendations for further research will be found in

Chapter V.

an article written by Masin,² "Foul Shooting for the Best Results, Use the Underhand Style." There is no consideration made of any other style of free throwing, but an explanation of the correct form to use in the two hand underhand method is presented:

Both feet are placed parallel, the ball is held by the finger tips, the arms extended, the hands in line with the hips. In the execution, the ball is dropped level with the knees and then swung forward in an arc and released shoulder high, all of this timed with an extension of the knees.

Masin adds that the chest shot is more difficult because of the excess wrist action.

Carlson³ maintains that the big muscles are used more in

² H. L. Masin, "Foul Shooting; for Best Results, Use the Underhand Style," *Scholastic*, 33:28, December 17, 1938.

³ Henry C. Carlson, *Basketball the American Game*. New York: Funk and Wagnalls, 1938. pp. 72-73.

CHAPTER II

REVIEW OF THE LITERATURE

Much has been written in regard to foul shooting in basketball but very little experimental study has been made on the subject. To a great extent, statements made are opinions of coaches based only on practical observations.

The literature available is almost unanimous in recommending the two hand underhand style. In several books, the name "free throw shot" is given to the underhand method. Approximately eighty per cent of the publications of coaches recommend the two hand underhand shot for all sizes and ages of players.

In an article written by Masin,² "Foul Shooting for the Best Results, Use the Underhand Style." There is no consideration made of any other style of free throwing, but an explanation of the correct form to use in the two hand underhand method is presented:

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the underhand shot. These big muscles are more easily trained and their use results in more accuracy than the employment of the small muscles. It does not require the muscle tension of the push shot, and appears to relax the player more. Murphy⁴ gives the reasons for the use of the underhand shot as follows: "This seems to be the most natural and accurate form since it uses large flexors rather than extensor muscles. Moreover, the center of gravity is lower and nearer the feet, the base of operation." Jourdet and Hashagen⁵ recommend the underhand shot as do Bunn,⁶ Barry,⁷ Jones,⁸ Mather,⁹ and Veenker.¹⁰

Another author, Wardlaw,¹¹ states that the natural method for an inexperienced player is the underhand shot but that the push of our shots. Bas¹⁴ states that two methods are used in attempting

⁴ Charles C. Murphy, Basketball. New York: A. S. Barnes and Company, 1939. pp. 17-18.

⁵ L. W. Jourdet and K. A. Hashagen, Modern Basketball. Philadelphia: W. B. Saunders Company, 1932. pp. 23-28.

⁶ John W. Bunn, Basketball Methods. New York: The Macmillan Company, 1939. pp. 130-45.

⁷ Justin McCarthy Barry, Basketball. Iowa City: Clio Press, 1926. pp. 63-64.

⁸ Ralph Jones, Basketball from a Coaching Standpoint. Champaign: Author, 1916. pp. 7-8.

⁹ Edwin J. Mather, Basketball How to Coach the Game. New York: A. S. Barnes and Company, 1925. pp. 52-53.

¹⁰ George F. Veenker, Basketball for Coaches and Players. New York: A. S. Barnes and Company, 1929. pp. 79-80.

¹¹ Charles D. Wardlaw, Basketball A Handbook for Coaches and Players. New York: Charles Scribner's Sons, 1921. pp. 27-30.

¹⁵ Forrest C. Allen, Better Basketball. New York: Whittlesey House, 1937. pp. 154-58.

shot may be used after a number of years of experience. Hobson¹² believes that the underhand shot is still the most accurate for the majority and that it will pay dividends to spend extra time in teaching the underhand free throw to most players. In close observation of different styles of shooting used in fifty-two major games played in New York City during the 1944-45 season it was indicated that the underhand free throw is the most accurate. Rupp¹³ recommends the two hand underhand shot and says that probably the first shot ever taken at a basket by anyone will be the two handed underhand shot. In watching a group of small boys play he observed that everyone of them used the underhand shot. Since the shot is so easily made it becomes the most mechanical of all of our shots. Bee¹⁴ states that two methods are used in attempting the free throw. Undoubtedly the underhand shot is more accurate than the overhand. However, the underhand shot is seldom used during the progress of a game and probably better all around shooting will result when the overhead type of shot is used.

Allen¹⁵ has two chief reasons for advocating the use of the underhand shot. First, the underhand shot involves the use of the flexors in place of the extensors and is easier to learn. Second,

¹² Howard A. Hobson, Scientific Basketball. New York: Prentice-Hall Inc., 1950. pp. 62-69.

¹³ Adolph Rupp, Championship Basketball, New York: Prentice-Hall Inc., 1948. pp. 46-48.

¹⁴ Clare Bee, Drills and Fundamentals, New York: A. S. Barnes and Company, 1942. pp. 61-62.

¹⁵ Forrest C. Allen, Better Basketball. New York: Whittlesey House, 1937. pp. 154-58.

"It is thirteen feet nine inches from the center of the basket to the free throw line; thus the pull shot will be released higher than the push shot." So the ball covers a shorter distance unguided in the pull shot than in the push shot.

Meanwell¹⁶ takes into consideration the anatomy and physiology involved to give a more natural basis for the underhand shot for younger and less experienced players while recommending the chest shot for more mature players. His reasons are: The underhand shot involves the flexors and is easier to learn. Although the extensors are used in the chest shot, it has the more desirable features of having a direct line of vision and less movement of the body.

Lambert¹⁷ believes that there are a number of various successful ideas as to the type of shot to be used but the underlying principle of all such successful ideas is that a motor reflex form be so well drilled that it becomes a well grounded habit. A player on the foul line should perform this habit correctly, regardless of situations in the game. The two types of free throws used are the underhand swing shot, and the push or chest shot. In the underhand shot, which is the more natural, more delicate muscles of forearm and biceps are used; the knee bend is combined with this shot. In the chest or push shot, there is a pull on the

¹⁶ Walter E. Meanwell, The Science of Basketball. Madison: H. D. Gath Publishing Company, 1924. pp. 94-96.

¹⁷ Ward L. Lambert, Practical Basketball. Chicago: Athletic Journal Publishing Company, 1932. pp. 56-60.

heavier back muscles. In both shots, the finish is in the wrist and fingers. The coach who believes in the push shot as a team shot is more consistent if he follows this teaching in free throwing, but at the same time Lambert believes the underhand swing shot more delicate and more accurate.

Holman¹⁸ says there are three major techniques in executing the free throw: the one handed push shot, the two handed overhead shot and the underhand shot. The technique which is recommended to all players is the underhand shot. Most statistical studies indicate that the underhand shot is the most effective free throw shot to be used.

Dean¹⁹ states that there is a divergence of opinion as to the better method of free throwing. The individual aptitudes and naturalness should be the deciding factor. Until recent years the underhand style was advocated by most coaches. However, there are many coaches swinging over to the type of shot for free throws that their teams use from the field.

In the thesis written by Marberry,²⁰ his experimental study of three methods of foul shooting is described. In attempting to measure the effectiveness of foul shooting he tested

¹⁸ Nat Holman, Holman on Basketball. New York: Crown Publishers, 1950. pp. 65-69.

¹⁹ Everett S. Dean, Progressive Basketball. Palo Alto: Stanford University Press, 1942. pp. 111-116.

²⁰ James William Marberry, "A Mechanical Analysis and Experimental Study of the Technique of Foul Throwing," (Unpublished Master's thesis, State University of Iowa, Iowa City, 1949.) 35 pp.

fifteen high school boys fifteen years of age or younger. The three methods of shooting tested were: (1) The underhand "pull" shot, (2) The overhand "push" shot, and (3) The newly developed one-hand "push" shot. In his opinion any of the three types of shots can be used successfully on the foul line. He found by the percentage method that the one-hand shot improved 10 per cent, the underhand shot improved 8 per cent and the chest shot improved 7 per cent. Of the three styles of shooting, the greatest improvement was in the one-hand form. He says that this is partially true because this style of shooting was the least familiar to the group at the beginning of the study, but also that this group was composed of boys who were not too familiar with any style.

Chandler,²¹ in his thesis, found that there was a high correlation between scholastic ability and free throw shooting ability. He used as his subjects the ten men on his Marquette University basketball squad. Each member shot free throws each day in his own method of shooting. A weight chart was kept by recording weights before and after each practice session to see if gaining or losing of weight had any effect on the free throw shooting results. In the study it was found that some players hit an early peak in scoring free throws and that others reached their greatest degree of proficiency later in the season. He also found that free throw shooting in victory was more proficient than in defeat.

²¹ William S. Chandler, "A Scientific Study of Free Throwing," (Unpublished Master's thesis, University of Wisconsin, Madison, 1932.) 32 pp.

CHAPTER III

The conclusions in these various studies regarding free throw shooting indicates that there is no complete agreement among the various authorities as to the better method of shooting.

The subjects for this study were forty boys who were students at Central College. This group was composed of freshmen and sophomores who were twenty years of age or younger and had had no previous high school varsity experience or coaching in basketball or free throw shooting.

In order to determine if one method of shooting free throws was more effective than another method, factors which might account for differences in ability to learn had to be equated.

This was done by the selection of two experimental groups and two methods of shooting free throws.

Selection of two experimental groups

The students who were used in this experiment were in the men's physical education activity classes at Central College. Any boy who was either a freshman or sophomore and had had no previous high school varsity experience or coaching in basketball or free throw shooting was invited to participate in the experiment. The subjects who participated in the experiment did so on a volunteer basis with the understanding that they were to practice shooting free throws under supervision five days a week and were not to participate in basketball of any other form for the duration of the study.

Administration of a general ability test given to the groups

CHAPTER III

PROCEDURE

The problem was to investigate the relative effectiveness

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as excellent tests for determining general athletic ability by Doctor David K. Brace, Chairman, Selection of two experimental groups

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Administration of a general athletic ability test given to the groups

The problem was to investigate the relative effectiveness of the two methods of foul shooting. In order to do this, it was necessary to account for, in so far as possible, all other factors which might influence the results. A general athletic ability test was given each subject to determine the general athletic ability of each subject. The first day the classes met, the subjects took these tests. Each subject was dressed in regulation gym suits which, as used by Central College students, consisted of white shorts, T shirt, white socks, and gym shoes. The general athletic ability test given was a battery of tests of running, throwing, and jumping. These tests were suggested as excellent tests for determining general athletic ability by Doctor David K. Brace, Chairman, Department of Physical and Health Education, University of Texas and confirmed by Doctor C. H. McCloy of the State University of Iowa, Department of Physical Education. In communication with Doctor McCloy, he stated that if the test is administered several times and the best scores are taken each time, it's reliability is better than .90. The tests were given three times. A description of the battery follows. The first test of the general athletic ability battery given to the subjects was the Fifty Yard Dash. The straightaway of the cinder running track provided a suitable area for testing. The equipment needed in testing was a stop watch, a whistle, a starting pistol, a clip board with a score sheet attached, and a pencil. The description of the race follows:

The subject starts in a crouched position with the hands behind the starting line. On the signal, To Your Marks, the subject takes his position on the starting line. On the signal Get Set, the subject is in readiness for the starting shot from the pistol. At the report of the pistol, the subject was directed to run as quickly as he could to the finish line. The subjects score is the number of seconds and tenths of seconds required to run the fifty yards.

The second part of the general athletic ability test was the Basketball Throw for distance. The space needed for this event was an open area about 150 feet long and sixty feet wide. A throwing line twenty feet long was marked on one end of the course with parallel lines marked every five feet beginning thirty feet in front of the throwing line. The following instructions were given to the subjects:

Start anywhere you wish behind the throwing line, but do not step on or across the line when throwing. Throw in any way that you like, three consecutive times. The score on the throw is the distance that the ball travels in the air from the throwing line to where it touches the ground. Only the longest throw was recorded.

The third part of the general athletic ability test was the Standing Broad Jump. The test was given indoors on the gymnasium floor. The test required a smooth surface and was marked off in one inch intervals with a tape measure to eliminate the need for measuring each jump. The description of the standing broad jump follows:

The subject stands on the smooth surface of the floor and the toes behind the starting line. The take off is from both feet simultaneously; the jump is as far forward as possible. The score is the distance from the edge of the starting line to the nearest heel mark or the nearest mark made by any part of the body or apparel touching the floor. The best of three trials will be counted.

The general athletic ability test given in this study was administered with the help of senior men physical education majors at Central College. Without the help of these boys the tests would have taken more than a single class period. Each battery of tests was given three times on three different days. On the days the general athletic ability tests were given the entire tests were explained and demonstrated to all the subjects before the tests began. The same directions were given to everyone. The parts of the test were given in the following order: first, fifty yard dash, second, the basketball throw for distance, and third, the standing broad jump. The "T" Scores and results of the general athletic ability test are shown in tables I and II on pages 19 and 20.

After the subject finished taking the athletic ability test, each took an initial free throw shooting test of one hundred shots using the one hand push method and the following day took one hundred shots using the two hand underhand method. Because there were six baskets in the gymnasium the subjects were divided into six groups. There were four subjects in two of the groups and three subjects in four of the groups. To eliminate the element of fatigue, each subject shot ten free throws in succession and then rested until all the shooters in his group were finished before shooting again.

Every attempt was made to keep the test conditions constant. The gymnasium was well lighted, well ventilated, and confusion was kept to a minimum.

Each subject received the same directions. The instruction was given orally and was accompanied by a demonstration of each method of foul shooting on each day for each subject before the subject started his shooting. The subjects were urged and encouraged to do their best in all test, practice, and instruction sessions. The instruction and demonstration was given by the experimenter. The results of the initial foul shooting test are shown in tables III and IV on pages 21 and 22.

ONE HAND	SOFT	BASKETBALL	BROAD	TOTAL	AVERAGE
E. J.	47	61.5	55	186.5	62.1
R. B.	67	59.5	55	181.5	60.5
L. D.	66.5	60	50.5	177	58.3
C. W.	57	51.5	61.5	170	56.7
H. B.	53.5	51.5	58	163	54.3
G. V.	46	55.5	60.5	162	54.0
J. H.	50	61.5	46.5	158	52.6
J. K.	50	50	53.5	153.5	51.1
J. C.	50	44	58	152	50.6
K. V.	50	52.5	46.5	149	49.6
M. S.	38.5	53.5	53.5	145.5	48.5
J. T.	50	47.5	46.5	144	48.0
L. W.	40.5	50	51.5	142	47.3
J. W.	40.5	45.5	52.5	138.5	46.1
G. O.	46	40	50.5	136.5	45.5
L. A.	50	45	36.5	131.5	43.8
C. K.	46	41.5	43	129.5	43.1
R. U.	40	37	45	122	40.6
D. V.	34	47.5	37.5	119	39.6
R. B.	34	30	33.5	97.5	32.5

TABLE I

"T" SCORES MADE BY GROUP I IN THE
ATHLETIC ABILITY TEST

ONE HAND GROUP	50YD DASH	BASKETBALL THROW	BROAD JUMP	TOTAL	AVERAGE
E. J.	67	64.5	55	186.5	62.1
R. B.	67	59.5	55	181.5	60.5
L. D.	64.5	60	50.5	175.5	58.3
C. W.	57	54.5	61.5	173	57.7
H. B.	53.5	51.5	58	163.5	54.3
G. V.	46	55.5	60.5	162	54.0
J. N.	50	61.5	46.5	158	52.6
J. K.	50	50	53.5	153.5	51.1
J. C.	50	44	58	152	50.6
K. V.	50	52.5	46.5	149	49.6
M. S.	38.5	53.5	53.5	145.5	48.5
J. T.	50	47.5	46.5	144	48.0
L. W.	40.5	50	51.5	142	47.3
J. W.	40.5	45.5	52.5	138.5	46.1
G. O.	46	40	50.5	136.5	45.5
L. A.	50	45	36.5	131.5	43.8
C. K.	46	41.5	43	129.5	43.1
R. U.	40	37	45	122	40.6
D. V.	34	47.5	37.5	119	39.6
R. B.	34	30	33.5	97.5	32.5

TABLE II

"T" SCORES MADE BY GROUP II IN THE
ATHLETIC ABILITY TEST

TWO HAND GROUP	50YD DASH	BASKETBALL THROW	BROAD JUMP	TOTAL	AVERAGE
K. V.	59	61.5	68	188.5	62.8
R. V.	59	66.5	56	181.5	60.5
A. K.	72	43.5	58	173.5	57.8
H. K.	50	64.5	50.5	165	55.0
R. W.	53.5	58.5	50.5	162.5	54.1
R. T.	59	59.5	41.5	162	53.3
R. D.	53.5	47.5	58	159	53.0
R. H.	59	36	58	153	51.0
M. H.	55	50	46.5	151.5	50.5
M. M.	50	48.5	50.5	149	49.6
G. H.	50	40	56	146	48.6
H. V.	40	49	55	144	48.0
A. F.	40.5	54.5	46.5	141.5	47.1
C. A.	42.5	53.5	44.5	140.5	46.8
W. K.	42.5	45.5	51.5	139.5	46.5
R. P.	46	46.5	41.5	134	44.6
S. G.	42.5	40	44.5	127	42.3
W. B.	42.5	45.5	37.5	125.5	41.8
R. D.	46	33.5	41	120.5	40.1
L. J.	34	30	33.5	97.5	32.5

TABLE III

SCORES MADE BY GROUP I IN THE INITIAL FOUL SHOOTING TEST

One Hand Group	Number of shots made out of 100 attempts	
	One hand Method	Two hand Method
E. J.	46	43
R. B.	56	45
L. D.	47	39
C. W.	31	27
H. B.	47	47
G. V.	38	35
J. N.	56	40
J. K.	45	41
J. C.	40	43
K. V.	39	28
M. S.	50	30
J. T.	43	21
L. W.	24	30
J. W.	25	40
G. O.	25	34
L. A.	32	24
C. K.	26	22
R. U.	22	20
D. V.	49	41
R. B.	30	26

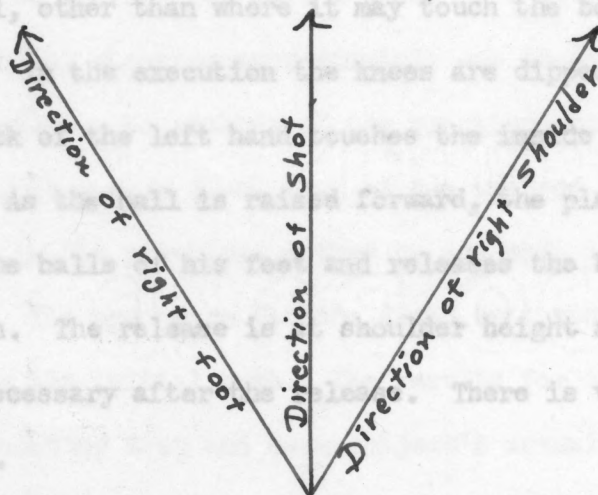
TABLE IV

SCORES MADE BY GROUP II IN THE INITIAL FOUL SHOOTING TEST

Two Hand Group	Number of shots made out of 100 attempts	
	One hand Method	Two hand Method
K. V.	22	31
R. V.	39	43
A. K.	17	33
H. K.	28	40
R. W.	52	39
R. T.	32	43
R. D.	21	30
R. H.	13	24
M. H.	60	51
M. M.	19	16
G. H.	38	55
H. V.	30	33
A. F.	51	39
W. K.	48	30
C. A.	30	28
R. P.	23	21
S. G.	30	37
W. B.	26	26
R. D.	16	19
L. J.	25	29

Teaching procedure for the one-hand shot

For a right hand shooter, the right foot is forward and the left foot is placed comfortably in the rear. The side of the body is toward the basket. The path of the shot is to bisect the angle formed by the direction in which the right foot is pointed with the direction in which the right shoulder is pointed, as the diagram below illustrates.



The ball is held in the fingertips of the left hand and is guided by the fingertips of the right hand behind the ball. The ball is held in front of the face to aid in sighting. In the execution of the shot, the weight of the body is dropped straight down into a half squat. Extension of the body and right arm with a rising onto the balls of the feet bring about the release of the ball well above the forehead.

The mean for Group I was found to be 49.29 and the mean for Group II was found to be 49.33. The standard deviation for Group I was 7.26 and for Group II was 7.32. In athletic ability the two groups were

Teaching procedure for the two-hand underhand shot

The feet are comfortably spread. The right foot is slightly back from the free throw line so that the ball of the right foot is in line with the instep of the left foot and the weight is evenly distributed on both feet. The body is erect. The arms are in easy extension with the palms of the hands facing each other. The ball is held in front of and against the body. The only contact with the ball, other than where it may touch the body, is the finger tips. In the execution the knees are dipped and spread until the back of the left hand touches the inside front of the left thigh. As the ball is raised forward, the player rises forward on the balls of his feet and releases the ball in an unbroken motion. The release is at shoulder height and a follow-through is necessary after the release. There is very little wrist action.

The forty subjects selected for this study were equated into two comparable groups. The results of the athletic ability tests were the basis for the equating. The raw score each subject made on each test was converted into a "T" Score. To find the average "T" Score for each subject, all the "T" Scores were added together and then divided by the number of tests which in this case was three. After the subjects were paired as nearly equal as possible the mean and the standard deviation were found for each group. The mean for Group I was found to be 49.29 and the mean for Group II was found to be 49.30. The standard deviation for Group I was 7.26 and for Group II was 7.02. In athletic ability the two groups were

practically equal. The computations of the motor skills as indicated by the athletic ability test are shown in tables V and VI on pages 26 and 27.

The subjects selected for the study were divided into Group I, who were taught the one hand push shot, and Group II, who were taught the two hand underhand shot. Each subject was instructed daily and practiced twenty-five shots a day for a period of eight weeks, five days a week, or a total of forty days with each subject shooting approximately one thousand shots in his particular method. No records of the practice shots were kept. After the eighth week a final test of one hundred shots was given each subject in his practiced method to see what improvement was made if any. The procedure for the final test was the same as that used for the initial test. The results for the initial and final foul shooting test and each subject's actual gain in shooting are shown in tables VII and VIII on pages 28 and 29.

E. J.	62.1	12.81	124.976
R. B.	60.5	11.21	123.664
L. D.	58.3	9.01	81.180
C. W.	57.7	8.41	70.748
R. S.	54.3	5.61	25.100
G. V.	54.0	4.71	22.184
J. N.	52.6	3.31	10.956
J. K.	51.1	1.81	3.276
J. C.	50.6	1.31	1.716
K. V.	49.6	.31	.096
M. S.	48.5	-.79	.624
J. T.	48.0	-1.29	1.664
L. W.	47.3	-1.99	3.960
J. W.	46.1	-3.19	10.176
G. O.	45.5	-3.79	14.364
L. A.	43.8	-5.49	30.140
C. K.	43.1	-6.19	38.316
R. U.	40.6	-8.69	75.516
D. V.	39.6	-9.69	93.896
H. B.	32.5	-16.79	281.904

Arithmetic Mean ($\bar{X}$) equals 49.29

Standard Deviation equals 7.26

TABLE V
COMPUTATIONS OF
STANDARD DEVIATION OF MOTOR SKILLS

ONE HAND GROUP	T SCORES (x_i)	DEVIATION FROM MEAN $x_i - \bar{x}$	$(x_i - \bar{x})^2$
E. J.	62.1	12.81	164.096
R. B.	60.5	11.21	125.664
L. D.	58.3	9.01	81.180
C. W.	57.7	8.41	70.728
H. B.	54.3	5.01	25.100
G. V.	54.0	4.71	22.184
J. N.	52.6	3.31	10.956
J. K.	51.1	1.81	3.276
J. C.	50.6	1.31	1.716
K. V.	49.6	.31	.096
M. S.	48.5	-.79	.624
J. T.	48.0	-1.29	1.664
L. W.	47.3	-1.99	3.960
J. W.	46.1	-3.19	10.176
G. O.	45.5	-3.79	14.364
L. A.	43.8	-5.49	30.140
C. K.	43.1	-6.19	38.316
R. U.	40.6	-8.69	75.516
D. V.	39.6	-9.69	93.896
R. B.	32.5	-16.79	281.904

Arithmetic Mean ($\bar{x}$) equals 49.29

Standard Deviation equals 7.26

TABLE VI

SCORES AND ACTUAL COMPUTATIONS OF T IN THE FINAL FOUR
SHOOTING STANDARD DEVIATION OF MOTOR SKILLS SHOOTING TEST

TWO HAND GROUP	T SCORES (X_i)	DEVIATION FROM MEAN $X_i - \bar{X}$	$(X_i - \bar{X})^2$
K. V.	62.8	13.5	182.25
R. V.	60.5	11.2	125.44
A. K.	57.8	8.5	72.25
H. K.	55.0	5.7	32.49
R. W.	54.1	4.8	23.04
R. T.	53.3	4.0	16.00
R. D.	53.0	3.7	13.69
R. H.	51.0	1.7	2.89
M. H.	50.5	1.2	1.44
M. M.	49.6	.3	.09
G. H.	48.6	-.7	.49
H. V.	48.0	-1.3	1.69
A. F.	47.1	-2.2	4.84
C. A.	46.8	-2.5	6.25
W. K.	46.5	-2.8	7.84
R. P.	44.6	-4.7	22.09
S. G.	42.3	-7.0	49.00
W. B.	41.8	-7.5	56.25
R. D.	40.1	-9.2	84.64
L. J.	32.5	-16.8	282.24

Arithmetic Mean ($\bar{X}$) equals 49.30

Standard Deviation equals 7.02

TABLE VII

SCORES AND ACTUAL GAIN MADE BY GROUP I IN THE FINAL FOUL
SHOOTING TEST OVER THE INITIAL FOUL SHOOTING TEST

One Hand Group	Number of shots made out of 100 attempts		
	Initial Test	Final Test	Actual Gain
E. J.	46	61	15
R. B.	56	61	5
L. D.	47	55	8
C. W.	31	34	3
H. B.	47	53	6
G. V.	38	42	4
J. N.	56	66	10
J. K.	45	52	7
J. C.	40	67	27
K. V.	39	48	9
M. S.	50	60	10
J. T.	43	65	22
L. W.	24	41	17
J. W.	25	49	24
G. O.	25	35	10
L. A.	32	38	6
C. K.	26	43	17
R. U.	22	30	8
D. V.	49	57	8
R. B.	30	36	6
Total	<u>771</u>	<u>993</u>	<u>222</u>

TABLE VIII

SCORES AND ACTUAL GAIN MADE BY GROUP II IN THE FINAL FOUL SHOOTING TEST OVER THE INITIAL FOUL SHOOTING TEST

Two Hand Group	Number of shots made out of 100 attempts		
	Initial Test	Final Test	Actual Gain
K. V.	31	54	23
R. V.	43	79	36
A. K.	33	37	4
H. K.	40	63	23
R. W.	39	48	9
R. T.	43	50	7
R. D.	30	42	12
R. H.	24	34	10
M. H.	51	58	7
M. M.	16	32	16
G. H.	55	65	10
H. V.	33	52	19
A. F.	39	58	19
W. K.	30	50	20
C. A.	28	44	16
R. P.	21	29	8
S. G.	37	48	11
W. B.	26	40	14
R. D.	19	40	21
L. J.	29	58	29
Total	667	981	314

CHAPTER IV

ANALYSIS AND INTERPRETATION OF DATA

Treatment of the data

The data for this study were collected during the first semester of 1951, at Central College, Pella, Iowa. Two classes of men's physical education activity classes were included in the study. The data obtained from the two classes were combined for the statistical purposes of this study. These two classes were divided into two comparable groups. Group I was composed of twenty subjects who were instructed in one hand free throw shooting. Group II was composed of twenty subjects who were instructed in two hand underhand free throw shooting.

Analysis of the data

The reason for this study was to determine the relative effectiveness of two methods of teaching free throw shooting. To find out if the improvement made by either the one hand group or the two hand group was significantly greater than that made by the other it was necessary to obtain the mean differences between the initial test scores and the final test scores for each group. The scores on the initial free throw shooting test were compared with the scores made on the final free throw shooting test for each student. The differences between these two scores were recorded. The calculation of the mean improvement was then made. The standard deviation and the standard error of

the mean were found for both the one hand push shot group and the two hand underhand shot group. The standard error of the difference between the two means was found in order to determine the significance of the difference between the two means.

The mean improvement for the one hand push shot group was 11.1, and the standard deviation was 6.64. The majority of the shots made in the one hand push shot group were between the range or limits of 11.1 ± 6.64 shots or between 4.46 and 17.74. The mean improvement for the two hand underhand shot group was 15.7 and the standard deviation was 7.94. The majority of the shots made in the two hand underhand shot group were between the range or limits of 15.7 ± 7.94 shots or between 10.76 and 23.64.

When the formula $\sigma_M = \frac{\sigma}{\sqrt{N}}$ for calculating the standard error of the mean was used for both the one hand push shot group and the two hand underhand shot group the standard error of the mean for the one hand push shot group was found to be 1.4855 and for the two hand underhand shot group was found to be 1.7763.

The probable error of the mean for the two groups was found by multiplying the standard error of the mean by .6745 or the probable error of the mean equals 1.001 for the one hand push shot group and the probable error of the mean equals 1.198 for the two hand underhand shot group. The chances are 50-50 that the true mean for the one hand push shot group lies between 11.1 ± 1 or between 10.1 and 12.1 and for the two hand underhand shot group lies between 15.7 ± 1 or between 14.7 and 16.7.

The actual difference between the means for the one hand

push shot group and the two hand underhand shot group was 4.6. When the formula $\sigma_d = \sqrt{\sigma_{M_1}^2 + \sigma_{M_2}^2}$ for calculating the standard error of the difference between the two means was used, the standard error of the difference was found to be 2.31. We may say then that the chances are 68 in 100 that the obtained difference does not diverge from the true difference by more than ± 2.31 shots. In 68 per cent of all the samples the true difference will lie between $4.6 - 2.31$ or 2.29 and $4.6 + 2.31$ or 6.91 shots. There appears to be a difference of 4.6 shots between the average performance of the groups in favor of the two hand underhand shot method.

In order to compute the significance of the difference we must divide the standard error of the difference which gives us a "t" ratio of 2.0. For forty cases we have thirty-eight degrees of freedom. In the table for "t"²² with thirty-eight degrees of freedom a "t" ratio of 2.0 represents a level of significance of 5 per cent. We need therefore conclude that the two hand underhand shot group was significantly superior to the one hand push shot group.

In consulting statistical tables²³ this means that the chances are 5 to 100 that the obtained difference is due to the experimental factor of the one hand and two hand free throwing and not due to chance.

²² J.P. Guilford, Fundamental Statistics in Psychology and Education. New York: McGraw-Hill Book Company, Inc. 1950. pp 609-610.

²³ John F. Bovard, Frederick W. Cozens, and E. Patricia Hagman, Tests and Measurements in Physical Education. Philadelphia: W. B. Saunders Company, 1949. pp. 392.

TABLE IX

ACTUAL GAIN OR PROGRESS MADE BY GROUP I IN SHOOTING DUE TO
TRAINING AND HOW EACH SUBJECT VARIED FROM THE MEAN

One Hand Group	Actual Gain Xi	Deviation From Mean $Xi - \bar{X}$	Deviation From Mean Squared $(Xi - \bar{X})^2$
J. C.	27	15.9	225.81
J. W.	24	12.9	166.41
J. T.	22	10.9	118.81
L. W.	17	5.9	34.81
C. K.	17	5.9	34.81
E. J.	15	3.9	15.21
M. S.	10	-1.1	1.21
G. O.	10	-1.1	1.21
J. N.	10	-1.1	1.21
K. V.	9	-2.1	4.41
R. V.	8	-3.1	9.61
D. V.	8	-3.1	9.61
L. D.	8	-3.1	9.61
J. K.	7	-4.1	16.81
L. A.	6	-5.1	26.01
R. B.	6	-5.1	26.01
H. B.	6	-5.1	26.01
R. B.	5	-6.1	37.21
G. V.	4	-7.1	50.41
C. W.	3	-8.1	65.61

Mean equals 11.1 from the Mean is 7.94

Standard Deviation from the Mean is 6.64

TABLE X

ACTUAL GAIN OR PROGRESS MADE BY GROUP II IN SHOOTING DUE TO
TRAINING AND HOW EACH SUBJECT VARIED FROM THE MEAN

Two Hand Group	Actual Gain X_i	Deviation From Mean $X_i - \bar{X}$	Deviation From Mean Squared $(X_i - \bar{X})^2$
R. V.	36	20.3	412.09
L. J.	29	13.3	176.89
H. K.	23	7.3	53.29
K. V.	23	7.3	53.29
R. D.	21	5.3	28.09
W. K.	20	4.3	18.49
H. V.	19	3.3	10.89
A. F.	19	3.3	10.89
C. A.	16	.3	.09
M. M.	16	.3	.09
W. B.	14	-1.7	2.89
R. D.	12	-3.7	13.69
S. G.	11	-4.7	22.09
G. H.	10	-5.7	32.49
R. H.	10	-5.7	32.49
R. W.	9	-6.7	44.89
R. P.	8	-7.7	59.29
R. T.	7	-8.7	75.69
M. H.	7	-8.7	75.69
A. K.	4	-11.7	136.89

Mean is 15.7

Standard Deviation from the Mean is 7.94

CHAPTER V

SUMMARY AND CONCLUSIONS

The purpose of this study was to make a comparison of the relative effectiveness of two methods of free throw shooting in basketball. To make this comparison it was necessary to set up two different procedures of foul shooting. The two procedures were the one hand push shot method and the two hand underhand shot method. This difference was significant at the 5 per cent level. For

In selecting subjects, the experimenter selected only those students who had had no previous high school varsity experience or coaching in basketball or free throw shooting and who were twenty years of age or younger. Forty boys were selected and were equated into two comparable groups. Group I was taught the one hand push shot method and Group II was taught the two hand underhand shot method. The entire teaching and testing time for each group covered a period of nine weeks. Each subject was instructed daily and practiced twenty-five shots a day for a period of eight weeks, five days a week for a total of forty days with each subject practicing approximately one thousand shots in his particular method.

One week was used for preliminary testing. Of this, three periods were used for testing general athletic ability and two periods were used for free throw shooting. Each subject attempted one hundred free throw shots using the one hand method the first day and one hundred attempts with the two hand underhand method the second day.

A final test of one hundred shots in each subject's practiced method at the end of the experimental period provided the experimenter a basis upon which to judge the improvement of the groups, and thus the effectiveness of the two groups.

The mean improvement in shooting was 11.1 for the one hand group and 15.7 for the two hand group. The standard error of the difference between the two means was found to be 2.31. Since the actual difference between the two means was 4.6, and "t" equalled 2.0, this difference was significant at the 5 per cent level. For forty cases we have thirty-eight degrees of freedom. We need therefore conclude that in this study the two hand underhand shot group was significantly superior to the one hand push shot group.

Recommendations

It is suggested that further research be carried on in free throw shooting by using more than two methods of teaching free throws.

It is also suggested that a comparative study be carried on in free throw shooting in actual game conditions.

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