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A Correlation Between Space I.Q. and Performance in Basketball

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A CORRELATION BETWEEN SPACE I.Q.

AND PERFORMANCE IN BASKETBALL

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A Thesis

Presented to

The Graduate Faculty

Central Washington College of Education

_____

In Partial Fulfillment

of the Requirements for the Degree

Master of Education

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by

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APPROVED FOR THE GRADUATE FACULTY

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Albert H. Poffenroth, COMMITTEE CHAIRMAN

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Dohn A. Miller

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E. Oakland

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CHAPTER I

THE PROBLEM AND DEFINITION OF TERMS

During the past few years, there has been a great emphasis placed on screening students to find their intellectual abilities then placing them homogeneously in accordance with these abilities. This method has been used to group students of similar abilities homogeneously in one room or to break a particular class down and group within that class. Dr. Conant (4:26), in his booklet Education in the Junior High School Years, states that

> Many educators feel that by the time of the seventh grade the spread of pupil achievement has become so great that only an unusually competent teacher can provide suitable instruction for a cross section of the grade.

One area of the curriculum that often overlooks foretelling future performance is physical education. It is the opinion of this writer that by using the results of certain parts of selected I.Q. tests it might be possible to determine to a fairly high degree the future performance of an individual in certain sports activities. More particularly, it was the purpose of this study to investigate the potential future performance of an individual in basketball to determine if there is a correlation between space I.Q. and performance in basketball.

I. THE PROBLEM

Statement of the problem. As indicated above, it was

the purpose of this study (1) to see if there is a correlation between space I.Q. and performance in basketball. Further purposes were (2) to determine, if there is a correlation, to what degree it exists; and (3) to determine how to make maximum use of any correlation found to exist.

Importance of the study. Undoubtedly the greatest value of this study (if a correlation exists between space I.Q. and performance in basketball) is that it will save a basketball coach many hours in attempting to determine the best prospects for the team. It is not uncommon in the state of Washington to have as many as ninety or more players turn out for basketball during the first few weeks of the season. Thus the first few games of the season often become the time of many difficult decisions for the coaching staff. This could be avoided if there were a way to determine individual performance beforehand.

If it is found that a correlation exists between space I.Q. and performance in basketball, it is hoped that such could also be used by physical education teachers in their program. There have been some studies in the area of space I.Q. and physical and mental relationships. These will be discussed in Chapter two.

Scope of the study. This study was limited to (1) grades eight and nine at Prosser Junior High School during

the years 1956-1960 and (2) Prosser High School during the years 1958-1961.

Method and procedure used. During the years 1956-1961, a tabulation of common errors and performance points of basketball was kept. This was done by the writer with the help of fellow teachers in the school district. A copy of the charts used is in Appendixes B and C. The total performance points for each player were tabulated using two formulas, one for high school and one for junior high school. Briefly these formulas are FG plus FT plus A plus R minus BP minus T minus F equal total points of performance. This actually means that a person received plus points for doing the right thing such as making a field goal (FG) and minus points for errors such as a bad pass (BP). This will be fully explained in Chapter three. These results were tabulated to see if any correlation does exist between space I.Q. and performance in basketball. Space I.Q. was taken from that section of the SRA Primary Mental Abilities test (16:3) for Intermediate ages, 11-17, form AH, which includes verbal-meaning, space reasoning, number, and word fluency. The pamphlet was published by Science Research Associates. This test is given to all incoming seventh graders at Prosser Junior High School and a make up test is given to all students who missed the test or moved into the district after the seventh grade. A copy of the test is included in Appendix A.

II. DEFINITION OF TERMS USED

SRA Test. This refers to the Primary Mental Abilities
Test for Intermediate Ages-11-17, Form AH, which includes
verbal meaning, space reasoning, number, and word fluency.
This test was prepared by L. L. Thurstone of the University
of Chicago and Thelma Gwinn Thurstone, director, Bureau of
child study of the Chicago Public Schools, and published by
Science Research Associates, Inc., 57 West Grand Avenue,
Chicago 10, Illinois, 1947.

Space I.Q. The following is taken from the profile
sheet of the SRA Primary Mental Abilities Test for Inter-
mediate Ages 11-17:

> Space is the ability to think about objects in two or
> three dimensions. Blueprint reading for example requires
> this ability. The designer, electrician, machinist,
> pilot, engineer, and carpenter are typical workers who
> need ability to visualize objects in space. Space is
> helpful in geometry, mechanical drawing, art, manual
> training, radar, physics, and geography classes.

Assist. A pass or throw from one team member to
another that enables the receiver of the ball to be in a posi-
tion to score. (Whether the player with the opportunity to
make the shot makes it or not is unimportant). The point is
that he was given the ball and had the chance to score.

Bad pass. This is a pass by one member of the team
to another that was poorly thrown or did not get to the right

area of the body. (The generally accepted place of reception in basketball is between the shoulders and the waist).

Boxer's sidestep. This refers to a step to the side on the balls of the feet without crossing the legs.

Field goal. Putting the ball through the basket by shooting, tipping, or any other legal manner that results in two points for the offensive team is called a field goal.

Foul. This is a called violation by an official for any infraction of the rules of basketball which results in a free throw for a member of the opposing team. (For the purposes of this study, both personal and technical fouls will be considered as a called violation by an official).

Free throw. This is an attempt to put the ball through the basket after a called violation by an official against the opposing team, which, if made, will increase the score by one point. (For the purposes of this study, if an individual is shooting a free throw and makes it, but loses it due to a violation by a member of his own team, the individual will be credited with the free throw).

Rebound. This term means the act of establishing clear possession of the ball after it has been shot or thrown by a member of either team.

Shot chart. This is a chart kept by an individual watching a game (in this case basketball) to record certain specific information. A copy of the shot chart was used in this study is in Appendix B.

Traveling. Traveling is a called violation by an official for any of the following:

A. Receiving the ball and taking more than a two count step, or beginning the dribble before releasing the ball.

B. On a jump shot, retouching the floor before releasing the ball.

C. Dragging the foot to make advance or rolling or falling and making progress with the ball.

D. Landing on both feet and making a pivot on either after taking one count.

E. Taking more than one air dribble.

(For the purposes of this study, a called violation for "carrying the ball" will be included in traveling).

CHAPTER II

REVIEW OF THE LITERATURE

Much has been written in the field of tests and measurements concerning the ability of psychologists to test an individual and determine his ability in almost any given area. The purpose here is to state a very brief summary of the history of testing, to cite studies dealing with space I.Q., and to review selected tests for determining performance in basketball.

I. A BRIEF HISTORY
OF THE TESTING MOVEMENT

Since the beginning of time, man has noticed that there are great differences in the mental and physical make up of individuals. In the time of the cave man, the most common difference recognized was physical. Being able to recognize this and understand it often meant the difference between life and death. Although man saw this difference and accepted it, he did not understand it. Even today, scholars are still recognizing these differences and trying to understand them. Forest (6:67-80) in a recent study found that babies who were full term varied from 17 to 24 inches in length at birth. He also found that the tissues of these babies differ from individual to individual. Blair (3:127-138) found that when a random group of six-year olds enters the

first grade, two per cent of them will be below the average four-year olds in general mental development and two per cent will be above the average eight year olds. The question of mental and physical development is undoubtedly one that will be studied by man until the end of time.

The Greeks and Romans took distinct notice of the differences in physical and mental development within their society and tried to cultivate these differences into a utopian society. Plato (13:35-65) in The Republic advocated the use of these differences in physical and mental development for the good of society.

After the decline and fall of the Roman empire, there was a general retreat from learning. Even the church which produced the intellectual stimulation of this era suffered from intellectual deterioration. Experiments in science filled the intellectual climate of this era.

According to Cronbach (5:157), "The first systematic experimentation on individuals differences in behavior arose from the accidental discovery of differences in reaction time among astronomers." This was in 1796 when it was found that reaction time among those watching certain happenings involving stars varied considerably.

During the 1800's many men did much work in the field of testing and observing individual differences. To name them all would be impossible. One of the most outstanding of this era was Sir Francis Galton, who was concerned with

measuring physical characteristics such as keeness of senses, and mental imagery. Galton also attempted to measure superior intelligence and its predominance in certain families.

Wundt, in Germany, opened the first psychological laboratory, in Leipziz. He and his associates established laws which could be called quantitative psychological laws. These could be compared in form to laws of physics. However, these were general laws and did not refer to individuals.

In the United States in 1890, M. McKeen Cattell did experiments on reaction time of superior individuals. This could be compared to the first tests made at Greenwhich England mentioned above (5:157).

During the late 1800's and early 1900's, perhaps the greatest name in intelligence testing began to start experiments which would later be used as a guide for all testing. This was Alfred Binet. Binet, a French physician, began to study differences in mental ability of the children in and around Paris, France. This was the beginning of the modern day testing program. The Binet test was designed to tag and identify the nonlearners in the school system. Later it was to be used for a wider range of classification.

In 1910, Lewis M. Terman began experimentations with the Binet test and produced the Stanford Revision of the Binet test in 1916. This was revised in 1937 and again in 1960. In the book Measuring Intelligence, Lewis M. Terman and Maus A. Merrill (14:7) reported that the big object in their 1937

revision was to search for test material from the works of
others and that "the first principle of sifting was to give
preference, other things being equal, to types of test items
that experience has shown to yield high correlations with
acceptable criteria of intelligence." The end results of the
work by Terman, Merrill, and others led to the test that more
Americans have taken than any other test produced, the Stanford-
Binet test.

During the first World War, there was need for a test
that could be given to a great number of individuals with
minimum effort and in a hurry. This was the birth of the Army
Alpha test, actually the first test for large groups where
the individuals had to follow directions. It tested, among
other things, simple reasoning, arithmetic and general infor-
mation.

From the above, Otis and others adapted the Army Alpha
Test for civilian use and produced the same type of test,
with different content.

In 1938, L. L. Thurstone came out with his first Primary
Mental Abilities Test. (This was the beginning of many tests
which also include the main test being used in this study, the
SRA test). The basic idea behind this aptitude test is that
it departs from the theory of general intelligence as advanced
by Terman, Merrill, and others to the thought of factors in
intelligence. This theory is that although a person may
have a high level of general intelligence, one can test to see

which factors are the highest. In the first test, Thurstone had six basic factors to test. These were called prime factors, and from these a tester could determine the total picture and also see some of the highest factors in an individual's intelligence. This naturally led to much discussion among psychologists and is still something that is being debated. Thurstone at first thought that he had failed to prove his point, but later correlations using his tests proved they were valid.

In 1939, David Wechsler produced the Wechsler-Bellevue Scale, an outgrowth of his studies of the mentally retarded at Bellevue Hospital in New York. Wechsler divided his test into two parts. One part contained verbal tests such as general comprehension, a memory span test, and others. The second part of the test involves five tests of performance which includes putting things together. The original Wechsler-Bellevue test has been revised to the modern day WAIS Test (Wechsler Adult Intelligence Scale) and the WISC (Wechsler Intelligence Scale for Children). These two tests are being used by many to test general intelligence and stability.

During World War II, there was an immediate need for tests to measure an individual's adaptability to certain jobs. The end result of this need came in the form of many tests for service personnel that not only measured certain abilities such as ability to receive radio code or ability to receive flight instruction but also provided the field of education with tests for measuring personality, scholastic

aptitude, interest, and many other areas. This need for tests during World War II produced many tests that have been quite valuable in both industry and education.

It can be said that testing gives results high enough in significance to become the accepted way to determine how well an individual will do in a certain situation. These tests are not only given in schools, but in industry. Naturally they are not always right, but they are correct enough of the time to give a fairly high prediction of success. The tests included here are by no means all of the tests written, but it was felt that these were the more important milestones in the history of testing.

II. REVIEW OF TESTS AND STUDIES
INVOLVING SPACE I.Q.

L. L. Thurstone had in mind, when he brought out his Primary Mental Abilities Tests, that he would be able to predict the courses and jobs in which a person would succeed. It is with this in mind that we examine some of the correlations resulting from some of the studies involving Space I.Q. done by L. L. Thurstone and others using not only the S.R.A. Primary Mental Ability Test but other tests. Thurstone (16:13), in a study involving 500 students of grade 10B, found that by using the Spearman-Brown method, the reliability for space was .96. This was the highest of any of the five tests included in this study.

John R. Hills (8:615-622) conducted a study involving spatial ability and college mathematics grades. A constant correlation of S was found, with some mathematics courses being as high as .55. He carried this a little further and also stated that some of his correlations depended to a great degree on how the class in mathematics was being taught.

George K. Bennett (1:63) did a study involving space I.Q. and performance in watch repairing. He found a correlation of .69 between a person's space I.Q. and his performance in watch repairing. This is significant enough for most counselors to take into consideration when an individual expresses an interest in watch repairing.

The USES reports that by using the General, Form, Perception, and Manual Dexterity scores along with their own test, a person with a high space I.Q. will meet success as an engineer or a dentist. They further state that only a person with a high space I.Q. can get into these two courses. Other occupations where spatial ability seems to contribute to a high degree of success are those of draftsman, tabulating machine operator, and machine operator.

The Differential Appitude Test, more commonly referred to as the DAT, is used for educational and vocational guidance in many high schools. It contains seven subtests, each of which yields a separate score. One of these subtests is space relations, the ability to perceive a three dimensional object from a two-dimensional pattern. This test is useful

in engineering, architecture, and drafting. Although a very good test, it is a bit long (three hours) for high school students.

The Minnesota Paper Form Board, more commonly called the MPFB, is a paper-and-pencil test dealing with spatial relations. This test is a good predictor of success in shop, dentistry, art, and factory work. Henry E. Garrett (7:182), in _Testing for Teachers_, states that "a boy scoring high in the MPFB is not necessarily apt in engineering, dentistry, or art, but he has promise and is worth further consideration."

From the above tests and correlations, we can see that it is possible to use the spatial part of tests to determine to a rather high degree the prediction of success an individual will have in certain vocational fields. It is hoped that we will see something of a similar nature in the statistics in Chapter three.

III. REVIEW OF TESTS USED TO DETERMINE

BASKETBALL ABILITY

There are many methods to evaluate performance in physical education. Knapp (10:355), in _Testing Methods in Physical Education_, states that "basically evaluation consists of securing information about pupils and validly interpreting it." This information can take many forms. It can be anything from the number of bar dips that an individual can do to whether or not a student takes his clothes home

each Friday and brings them back each Monday freshly laundered. It is the basic concern here to evaluate the performance an individual makes as a basketball player.

Performance tests in the field of basketball have been quite numerous. It would be impossible to list all of the tests that have been designed. Tests involving ball handling and those which do not will be cited.

In the early 1930's, L. William Johnson (9:1-87) set out to devise a test for potential basketball ability. He divided 180 boys into two groups. The good group had 50 boys and the poor group had the rest. He had devised a series of 19 tests to screen for basketball ability. These included both tests of handling the ball and others which did not. The final result was that he narrowed his tests to three performance tests:

1. A player stands as close to a basket as he wants and in any position. On the signal from the tester, he shoots (using any shot he desires) as many baskets as he can in one minute. One point is given for each basket.

2. A large rectangle which contains two smaller rectangles is placed on the wall of the gymnasium. (It is similar in nature to the target when using a bow and arrow, only in the shape of a rectangle). A player stands forty feet away and takes ten passes at the chart using either the basketball pass or the hook pass. He receives three points

for hitting the rectangle in the center, two for the inner rectangle, and one for hitting the outer rectangle and line.

3. A dribbling test involving five hurdles a player must dribble around. A course thirty feet long is marked out with three hurdles six feet apart and one hurdle twelve feet apart from the other three. The player starts around the hurdle at the starting line and dribbles around the hurdles and back to the other end in a figure eight fashion. He receives one point for each zone he passes in thirty seconds.

Johnson figured the relationship between the test scores and the boy's ability to make the squad. The resulting validity coefficient of the test battery was .880. The reliability of the test battery was .890. Johnson also set up four tests which do not involve ball handling. These are running and crossing a given space as many times as possible using a boxer's sidestep, a jumping test for vertical distance, a zigzag run with obstacles, and the Iowa revision of the Brace test.

The Knox Basketball Test (11:1-55) produced by Robert D. Knox consists of four items:

1. Speed Dribble. The player upon the command "go" picks up a basketball and dribbles around four chairs and back. The first chair is twenty feet from the starting line and the succeeding chairs are fifteen feet apart. The time stops when the player returns to the starting line.

2. Dribble Shoot. Same as the above, only the player must make a basket before he returns. If he fails the first time, he continues until he makes the basket. The time stops when the player returns to the starting line.

3. Speed Pass. Using the chest pass, a player must hit the wall and rebound his ball fifteen times. The object is to see how quickly this can be done. The player stands behind a line five feet from the wall.

4. Penny-Cup Test. The player has his back to three cups twenty feet away. On the command "go" the player races toward the cups (three cups of different colors). The tester shouts the name of the color in which cup the penny is to be dropped. The player is tested on the time it takes to drop the penny into the cup. This test is repeated four times, and the total time is recorded.

Carlson Lehsten, in his test called the Lehsten Basketball Test (12:1-63), has five items that he feels are the items to check for basketball ability in high school students. These are:

1. Dodging Run. Using Cozen's course for dodge running, the player runs the course twice, as fast as he can. Time is recorded to the nearest tenth of a second.

2. The 40-Foot Dash. Standing upright on a basket-ball floor, the player runs the 40-Foot Dash as fast as he can. The time is recorded to the nearest tenth of a second.

3. Wall Bounce. A player stands six feet away from a rectangular target two feet wide by four feet high, three feet above the floor and bounces the ball against the target without its touching the floor as many times as he can in ten seconds.

4. Baskets Per Minute. The player makes as many baskets as he can in one minute using any type of shot he desires. He rebounds his own ball.

5. Vertical Jump. The player stands with his heels on the floor and reaches as far as possible and puts a mark on a board that is marked off in half inches. He then takes three jumps to see how high he can jump. The difference between his mark and his highest jump mark to the nearest half inch is his score.

The five scores are scaled and a composite score for the test is available.

The above three tests are by no means all of the basket-ball performance tests that have been used, but they represent some of the best tests devised. It is obvious that all three tests are somewhat similar in nature. If we continued to review basketball tests we would merely be repeating many of the ideas already presented.

CHAPTER III

PRESENTATION AND STATISTICAL
ANALYSIS OF DATA

The two preceeding chapters introduced the study and
gave a brief history of it. This chapter will present the
data that have been gathered and analyze such by using certain
selected formulas.

As was stated in Chapter one, the purpose of this
study was to determine if any correlation exists between space
I.Q. and performance in basketball. Performance in basket-
ball has been measured by two different standards, one for
high school students and one for junior high school students.
The reason for these two standards is that it is almost
impossible to compare these two age groups using the same
scale of performance due to the differences in physical ability
and physical development. There is also a difference in the
playing time for these two age groups. A regulation high
school basketball game consists of four quarters of eight
minutes each as compared with a regulation junior high school
basketball game of four quarters of six minutes each. To
determine performance of basketball ability for high school
students, a formula has been selected which gives one point
for each rebound, one point for each assist, one point for
each shot made, a minus point for each field goal missed

under one third of the total shooting percentage, a point for
each foul shot made, and a minus point for each shot missed
under two thirds of the shooting percentage, a minus point
for each foul be it personal or technical, and a minus point
for each called traveling violation. The reason for not
giving one point for each field goal made and subtracting
one point for each shot missed is that a high school student
should not be expected to make 50 per cent of his shots from
the floor. The 33 1/3 per cent figure selected is good
performance from the floor for high school students. On the
foul shots, the level of performance for high school students
should be approximately 66 2/3 per cent. The formula for
arriving at the total number of plus and minus points for
high school students is:

$$R+A+ 2(FGM) + 2 (FTM) - F - T - BP - 1/3 \ FGA - 2/3 \ FGA=$$
$$R+A+ 2 \ [(FGM + FTM)] \quad - \ [F+T+BP = 1/3 \ (FGA) + 2/3 \ (FTA)]$$

In the above formula, R stands for rebound, A for
assist, FG for field goal, FGA for field goals attempted, FGM
for field goals made, FT for free throw, FTA for free throws
attempted, FTM for free throws made, BP for bad pass, F for
foul, and T for traveling.

To determine performance for junior high school students,
the above formula remains the same with two exceptions. These
are the field goals and the foul shots. The player receives
one point for each field goal and minus points for each shot

missed above 25 per cent of the total field goals attempted.
The player will receive a plus point for each foul shot made
and a minus point for each foul shot missed. It is felt
that a junior high school student should make 25 per cent
of his shots from the floor and 50 per cent of his shots from
the foul line. The formula for finding the total plus and
minus points for junior high school students is:

$$R+A+ 2 \text{ (FGM)} + 2 \text{ (FTM)} - F - T - BP - 1/4 \text{ FGA} - 1/2 \text{ FTA}=$$

$$R+A+ 2 \llbracket\text{FGM} + \text{FTM}] - [(F+T+BP) + 1/4 \text{ (FTA)} + 1/2 \text{ (FTA)}\rrbracket$$

In the above formula, the letters mean the same as in
the high school formula.

An area of minimum performance has been established for
this study. As far as possible the players included in this
study have played approximately an equal amount of time or
quarters. It would give a distorted view if one were to
include all players on the team because there are those who
will play only a very few minutes or seconds depending on the
schedule and number of games won and lost in a given season.

After the plus and minus points have been totaled and
either a positive or negative total answer obtained, this
along with the scores of the players for this year are
correlated with space I.Q. to compute the coefficient of
correlation. The formula used to compute the coefficient of
correlation is the Pearson-Product Movement formula. Best
(2:236), in Research in Education, states that this formula
is practicable when an electric computer is used. This

formula is:

$$r = \frac{N.\Sigma XY - (\Sigma X.\Sigma Y)}{\sqrt{[N.\Sigma X^2 - (\Sigma X)^2]\,[N.\Sigma Y^2 - (\Sigma Y^2)]}}$$

N = Number

ΣX = Sum of the X scores

ΣY = Sum of the Y scores

ΣX^2 = Sum of the X scores squared

ΣY^2 = Sum of the Y scores squared

ΣXY = Sum of the product of X, Y scores

r = The correlation

Table I shows the space I.Q., individual performance points, and total performance points for sixteen players during the 1960-1961 basketball season at Prosser High School, Prosser, Washington. Space I.Q. scores range from a low of 11 to a high of 99. Total performance points range from a low of 12 1/3 to a high of 222. Player A. who had the highest space I.Q., was fifth in total performance points; and player P who had the lowest space I.Q., was in a tie for thirteenth position. Player H, who had a space I.Q. of 50, the middle range of space I.Q, was seventh in total performance points.

On the following page, the data presented above will be correlated using the Pearson-Product Movement Formula to determine the correlation between total performance points and space I.Q.

TABLE I

SPACE I.Q. AND PERFORMANCE POINTS FOR 1960-1961

HIGH SCHOOL BASKETBALL SEASON

SIQ	PL	FGM	FGA	FTM	FTA	RB	AST	FL	TR	BP	TPP		RK
99	A.	39	132	41	63	89	72	47	4	6	178		5
87	B.	70	179	39	63	88	68	23	8	9	222		1
83	C.	151	362	29	52	77	52	55	9	37	202	1/3	2
75	D.	81	189	30	49	89	60	52	11	21	173	1/3	6
72	E.	13	47	3	13	143	72	36	5	2	179	2/3	4
68	F.	86	232	44	69	102	55	55	11	22	197		3
54	G.	75	192	41	66	47	45	43	22	29	113		11
50	H.	40	87	41	65	86	48	31	10	24	147	2/3	7
36	I.	4	25	6	11	29	19	16	13	11	12	1/3	16
32	J.	64	167	30	51	41	69	70	14	29	87		12
30	K.	47	102	30	58	115	28	46	17	10	138	1/3	10
28	L.	68	159	38	63	88	41	40	18	28	145		8
25	M.	40	113	35	47	132	34	60	14	26	141		9
22	N.	34	84	25	35	19	52	19	12	26	73		14
22	O.	29	89	16	35	36	26	41	17	28	13		15
11	P.	44	153	37	55	52	33	45	12	29	73		13

NOTE: In the above table, SIQ stands for space I.Q., PL stands for player, FGM stands for field goals made, FGA stands for field goals attempted, FTM stands for free throws made, FTA stands for free throws attempted, RB stands for rebound, AST stands for assists, FL stands for foul, TR stands for traveling, BP stands for bad pass, TPP stands for total performance points, and RK stands for rank.

TABLE II

STATISTICAL ANALYSIS OF TABLE I USING

PEARSON-PRODUCT MOVEMENT FORMULA

	X	X^2	Y	Y^2	XY
A.	99	9801	178	31684	17622
B.	87	7569	222	49284	19314
C.	83	6889	202 1/3	40937.43	16793.39
D.	75	5625	173 1/3	30043.29	12999.75
E.	72	5184	179 2/3	32277.72	12911.76
F.	68	4624	197	38809	13396
G.	54	2916	113	12769	6102
H.	50	2500	147 2/3	21803.48	7383.5
I.	36	1296	12 1/3	152.03	443.88
J.	32	1024	87	7569	2784
K.	30	900	138 1/3	19135.19	4149.9
L.	28	784	145	21025	4060
M.	25	625	141	19881	3384
N.	22	484	73	5329	1606
O.	22	484	13	169	286
P.	11	121	73	5329	803
	794	50826	2095 2/3	336197.14	124039.18

$$
\begin{aligned}
&N (\Sigma X)^2 && 813,216 \\
&(\Sigma X)^2 && \underline{-630,436} \\
& && 182,780
\end{aligned}
$$

$$
\begin{aligned}
&N\Sigma Y^2 && 5,379,154.24 \\
&(\Sigma Y)^2 && \underline{-4,391,790.84} \\
& && 987,363.40
\end{aligned}
$$

$$
\begin{aligned}
&N\Sigma XY && 1,984,626.88 \\
&\Sigma X\Sigma Y && \underline{-1,663,954.04} \\
& && 320,672.84
\end{aligned}
$$

$$ r = \frac{320,672.84}{\sqrt{(182,780)(987,363)}} $$

$$ r = \frac{320,673}{\sqrt{180470209140}} $$

$$ r = .754 \text{ or } .75 $$

There is a correlation of .75 for the 1960-1961 high school basketball season using the data presented in Table I.

Table III shows the space I.Q., individual performance points, and total performance points for sixteen players during the 1959-1960 basketball season at Prosser High School, Prosser, Washington. Space I.Q. scores range from a low of 8 to a high of 99. Total performance points range from a low of 18 1/3 to a high of 431. Player A, who had the highest space I.Q., was first in total performance points; and player P, who had the lowest space I.Q., was in twelfth position. Player H, who had a space I.Q. of 54, in the middle range of space I.Q., was eighth in total performance points. If this were a perfect correlation, this is exactly where he should be.

On the following page, the data presented above will be correlated using the Pearson-Product Movement Formula to determine the correlation between total performance points and space I.Q.

Table V shows the space I.Q., individual performance points, and total performance points for fourteen players during the 1958-1959 basketball season at Prosser High School, Prosser, Washington. Space I.Q. scores range from a low of 8 to a high of 99. Total performance points range from a low of 17 1/3 to a high of 293 1/3. Player A, with the highest space I.Q., was first in total performance points. Player N, who had the lowest space I.Q., was in eleventh position. Player H, who had a space I.Q. of 51, in the middle

TABLE III

SPACE I.Q. AND PERFORMANCE POINTS FOR 1959-1960

HIGH SCHOOL BASKETBALL SEASON

SIQ	PL	FGM	FGA	FTM	FTA	RB	AST	FL	TR	BP	TPP		RK
99	A.	129/322		89/138		279	32	65	9	21	431		1
92	B.	78/179		50/114		115	48	52	14	34	165		4
80	C.	49/146		34/63		150	12	53	12	9	163		5
79	D.	39/117		14/25		29	17	22	8	8	58	1/3	10
77	E.	55/165		54/80		113	32	60	6	12	176		3
75	F.	31/110		24/50		95	22	35	6	18	98		6
72	G.	53/139		33/75		198	35	44	11	18	229		2
54	H.	68/187		29/58		38	26	46	8	19	78	1/3	8
44	I.	10/50		10/21		47	11	31	3	3	30	1/3	14
36	J.	36/131		27/48		97	31	68	10	34	66	1/3	9
28	K.	28/80		14/19		22	11	14	4	6	51		11
25	L.	44/129		33/57		127	12	83	16	31	81		7
23	M.	12/38		9/17		31	2	16	3	5	27		15
22	N.	27/91		7/25		24	17	20	6	3	33		13
22	O.	10/35		3/6		14	19	15	4	6	18	1/3	16
8	P.	16/47		36/72		45	9	35	4	31	36		12

NOTE: Abbreviations are the same as those explained in Table I, page 23.

TABLE IV

STATISTICAL ANALYSIS OF TABLE III USING

PEARSON-PRODUCT MOVEMENT FORMULA

	X	X^2	Y		Y^2	XY
A.	99	9801	431		185761	42669
B.	92	8464	165		27225	15180
C.	80	6400	163		26569	13040
D.	79	6241	58	1/3	3402.39	4608.07
E.	77	5929	176		30976	13552
F.	75	5625	98		9604	7350
G.	72	5184	299		89401	21528
H.	54	2916	78	1/3	6135.59	4229.82
I.	44	1936	30	1/3	919.91	1334.52
J.	36	1296	66	1/3	4399.67	2387.88
K.	28	784	51		2601	1428
L.	25	625	81		6561	2025
M.	23	529	27		729	621
N.	22	484	33		1089	726
O.	22	484	18	1/3	335.99	403.26
P.	8	64	36		1296	288
	836	56762	1811	2/3	397005.55	131370.55

$$
\begin{array}{ll}
N\,(\Sigma X)^2 & 908,192 \\
(\Sigma X)^2 & -698,896 \\
\hline
& 209,296
\end{array}
$$

$$
\begin{array}{ll}
N\Sigma Y^2 & 6,352,088.80 \\
(\Sigma Y)^2 & -3,282,148.19 \\
\hline
& 3,069,940.61
\end{array}
$$

$$
\begin{array}{ll}
N\Sigma XY & 2,101,928.80 \\
\Sigma X\Sigma Y & -1,514,556.12 \\
\hline
& 587,372.68
\end{array}
$$

$$r = \frac{587,373}{\sqrt{(209,296)(3,069,941)}}$$

$$r = \frac{587,373}{\sqrt{642,426,371,536}}$$

$$r = .732 \text{ or } .73$$

There is a correlation of .73 for the 1959-1960 high school basketball season using the data presented in Table III.

TABLE V

SPACE I.Q. AND PERFORMANCE POINTS FOR 1958-1959

HIGH SCHOOL BASKETBALL SEASON

SIQ	PL	FGM FGA	FTM FTA	RB	AST	FL	TR	BP	TPP		RK
99	A.	109/217	42/76	50	193	61	7	24	293	1/3	1
88	B.	127/337	44/63	61	101	52	9	32	240		2
85	C.	32/126	9/43	25	69	15	6	4	80	1/3	10
77	D.	32/77	23/47	68	139	51	10	9	183	2/3	3
75	E.	34/140	22/32	37	85	48	12	12	93	1/3	9
62	F.	54/108	47/85	19	137	67	8	29	143	1/3	5
54	G.	46/179	25/46	28	69	30	7	11	100	2/3	8
51	H.	30/82	22/31	18	77	23	6	10	108		7
50	I.	38/118	30/54	16	90	38	5	6	117	2/3	6
27	J.	6/22	7/17	18	30	21	8	9	17	1/3	14
25	K.	61/165	32/55	21	144	60	10	28	155	1/3	4
22	L.	19/103	6/17	22	49	27	4	6	38	1/3	13
12	M.	12/29	16/30	26	36	21	4	10	51		12
8	N.	52/136	30/64	20	56	54	7	23	61	1/3	11

NOTE: Abbreviations are the same as those explained in Table I, page 23.

range of space I.Q., was seventh in total performance points.

On the following page, the data presented above will be correlated using the Pearson-Product Movement Formula to determine the correlation between total performance points and space I.Q.

Table VII shows the space I.Q., individual performance points, and total performance points for fourteen players during the 1959-1960 basketball season at Prosser Junior High School, Prosser, Washington. Space I.Q. scores range from a low of 6 to a high of 99. Total performance points range from a low of -31 1/2 to a high of 80. Player A, with the highest space I.Q., was first in total performance points. Player N, with the lowest space I.Q., was in thirteenth position. Player G, who had a space I.Q. of 40, seventh from the top in space I.Q., was also seventh from the top in total performance points. If this were a perfect correlation, this is exactly where he should be.

On the following page, the data presented above will be correlated using the Pearson-Product Movement Formula to determine the correlation between total performance points and space I.Q.

Table IX shows the space I.Q., individual performance points, and total performance points for fifteen players during the 1958-1959 basketball season at Prosser Junior High School, Prosser, Washington. Space I.Q. scores range

TABLE VI

STATISTICAL ANALYSIS OF TABLE V USING

PEARSON-PRODUCT MOVEMENT FORMULA

	X	X^2	Y	Y^2	XY
A.	99	9801	293 1/3	86042.49	29039.67
B.	88	7744	240	57600	21120
C.	85	7225	80 1/3	6452.91	6828.05
D.	77	5929	183 2/3	33731	14142.59
E.	75	5625	93 1/3	8710.49	6999.75
F.	62	3844	143	20449	8866
G.	54	2916	100 2/3	10132.44	5436.18
H.	51	2601	108	11664	5508
I.	50	2500	117 2/3	13843.88	5883.50
J.	27	729	17 1/3	294.79	463.59
K.	25	625	155 1/3	24127.41	3883.25
L.	22	484	38 1/3	1469.19	843.26
M.	12	144	51	2601	612
N.	8	64	61 1/3	3761.37	490.64
	735	50231	1683 1/3	280879.97	110116.48

$$N \, (\Sigma X)^2 \qquad 803,696$$
$$(\Sigma X)^2 \qquad \underline{-540,225}$$
$$263,471$$

$$N\Sigma Y^2 \qquad 3,932,320$$
$$(\Sigma Y)^2 \qquad \underline{-2,833,061}$$
$$1,099,259$$

$$N\Sigma XY \qquad 1,541,630.72$$
$$\Sigma X \Sigma Y \qquad \underline{-1,237,129.95}$$
$$304,500.77$$

$$r = \frac{304,500.77}{\sqrt{(263,471)(1,099,259)}}$$

$$r = \frac{304,501}{\sqrt{289,622,867,989}}$$

$$r = .565 \text{ or } .57$$

There is a correlation of .57 for the 1958-1959 high school basketball season using the data presented in Table V.

TABLE VII

SPACE I.Q. AND PERFORMANCE POINTS FOR 1959-1960

JUNIOR HIGH SCHOOL BASKETBALL SEASON

SIQ	PL	FGM FGA	FTM FTA	RB	AST	FL	TR	BP	TPP	RK
99	A.	13/42	14/30	76	16	26	2	10	80	1
92	B.	19/45	7/17	36	18	10	7	3	58 1/2	4
89	C.	35/103	11/18	28	15	32	7	10	40	7
61	D.	22/81	18/32	29	22	12	7	22	50	5
56	E.	19/71	19/34	28	16	10	4	7	61	2
55	F.	20/76	14/32	52	7	17	6	7	61	2
40	G.	5/28	13/25	58	4	21	3	5	49	6
38	H.	16/64	13/28	22	13	16	11	11	26	9
37	I.	15/54	15/28	20	15	14	13	14	24	10
37	J.	10/48	14/26	23	12	25	12	14	6	12
22	K.	11/39	8/26	17	6	9	4	5	19	11
11	L.	31/112	25/42	13	9	28	6	13	31	8
7	M.	6/60	8/31	14	2	24	8	13	-31 1/2	14
6	N.	4/15	6/12	10	3	13	2	6	2	13

NOTE: Abbreviations are the same as those explained in Table I, page 23.

TABLE VIII

STATISTICAL ANALYSIS OF TABLE VII USING

PEARSON-PRODUCT MOVEMENT FORMULA

	X	X^2	Y	Y^2	XY
A.	99	9801	80	6400	7920
B.	92	8464	58 1/2	3422.25	5382
C.	89	7921	40	1600	3560
D.	61	3721	50	2500	3050
E.	56	3136	61	3721	3416
F.	55	3025	61	3721	3355
G.	40	1600	49	2401	1960
H.	38	1444	26	676	988
I.	37	1369	6	36	222
J.	37	1369	24	576	888
K.	22	484	19	361	418
L.	11	121	31	961	341
M.	7	49	-31 1/2	992.25	-220.5
N.	6	36	2	4	12
	650	42540	476	27371.50	31291.5

$$N (\Sigma X)^2 \quad\quad 595,560$$
$$(\Sigma X)^2 \quad\quad -422,500$$
$$\overline{173,060}$$

$$N\Sigma Y^2 \quad\quad 383,201$$
$$(\Sigma Y)^2 \quad\quad -226,576$$
$$\overline{156,625}$$

$$N\Sigma XY \quad\quad 438,081$$
$$\Sigma X\Sigma Y \quad\quad -309,400$$
$$\overline{128,681}$$

$$r = \frac{128,681}{\sqrt{(173,060)(156,625)}}$$

$$r = \frac{128,681}{\sqrt{27105522500}}$$

$$r = .782 \text{ or } .78$$

There is a correlation of .78 for the 1959-1960 junior high school basketball season using the data presented in Table VII.

TABLE IX

SPACE I.Q. AND PERFORMANCE POINTS FOR 1958-1959

JUNIOR HIGH SCHOOL BASKETBALL SEASON

SIQ	PL	FGM FGA	FTM FTA	RB	AST	FL	TR	BP	TPP		RK
99	A.	34/107	25/52	100	11	28	11	8	122		2
92	B.	37/134	20/56	83	29	43	7	12	89		4
86	C.	25/105	13/42	89	27	42	2	14	86	3/4	5
60	D.	42/164	13/43	106	8	20	2	6	132	1/2	1
50	E.	16/68	9/20	26	15	9	3	4	48		7
46	F.	16/82	12/25	68	25	14	4	7	91		3
39	G.	14/51	8/22	23	8	13	1	11	25		8
39	H.	3/15	0/4	8	1	6	3	7	-6	3/4	15
36	I.	17/63	19/40	49	18	19	5	7	71		6
32	J.	30/109	14/32	20	8	27	9	14	20		10
28	K.	7/29	9/14	12	9	5	2	7	22	3/4	9
23	L.	3/23	4/14	26	10	18	1	3	15	1/4	11
22	M.	22/96	12/26	24	18	38	4	21	10		14
22	N.	8/30	9/26	16	9	8	7	9	14		12
11	O.	33/105	9/33	24	12	36	9	15	10	1/2	13

NOTE: Abbreviations are the same as those explained in Table I, page 23.

from a low of 11 to a high of 99. Total performance points
range from a low of -6 3/4 to a high of 132 1/2. Player A,
who had the highest space I.Q., was second in total perform-
ance points; and player O, who had the lowest space I.Q.,
was in thirteenth position. Players G and H, seventh and
eighth from the top in space I.Q., were eighth and last
respectively in total performance points.

On the following page, the data above will be cor-
related using the Pearson-Product Movement Formula to determine
the correlation between total performance points and space
I.Q.

Table XI shows the space I.Q., individual performance
points, and total performance points for fourteen players
during the 1957-1958 basketball season at Prosser Junior
Hish School, Prosser, Washington. Space I.Q. scores range
from a low of 8 to a high of 92, total performance points
from a low of 9 1/2 to a high of 92. Player A, who had the
highest space I.Q., was first in total performance points.
Player N, who had the lowest space I.Q., was in a tie for
eighth position. Player G, seventh from the top in space
I.Q., in the middle range of space I.Q., was third in total
performance points.

On the following page, the data above will be
correlated using the Pearson-Product Movement Formula to
determine the correlation between total performance points
and space I.Q.

TABLE X

STATISTICAL ANALYSIS OF TABLE IX USING

PEARSON-PRODUCT MOVEMENT FORMULA

	X	X^2	Y		Y^2	XY
A.	99	9801	122		14884	11880
B.	92	8464	99		9901	9108
C.	86	7396	86	3/4	7525.56	7460.5
D.	60	3600	132	1/2	17556.25	7950
E.	50	2500	48		2304	2400
F.	46	2116	91		8281	4186
G.	39	1521	25		625	975
H.	39	1521	-6	3/4	45.56	-263.25
I.	36	1296	71		5041	2556
J.	32	1024	20		400	640
K.	28	784	22	3/4	517.56	637
L.	23	529	15	1/4	232.56	350.75
M.	22	484	14		196	308
N.	22	484	10		100	220
O.	11	121	10	1/2	110.25	115.50
	685	41641	761		67619.74	48523.50

$$
\begin{array}{ll}
N\,(\Sigma X)^2 & 624,615 \\
(\Sigma X)^2 & \underline{-469,225} \\
& 155,390
\end{array}
$$

$$
\begin{array}{ll}
N\Sigma Y^2 & 1,014,296.10 \\
(\Sigma Y)^2 & \underline{579,121.00} \\
& 435,175.10
\end{array}
$$

$$
\begin{array}{ll}
N\Sigma XY & 727,852.5 \\
\Sigma X\Sigma Y & \underline{-521,285.0} \\
& 206,567.5
\end{array}
$$

$$
r = \frac{206,568}{\sqrt{(155,390)(435,175)}}
$$

$$
r = \frac{206.567}{\sqrt{67311063250}}
$$

$$
r = .795 \text{ or } .80
$$

There is a correlation of .80 for the 1958-1959 junior high school basketball season using the data presented in Table IX.

TABLE XI

SPACE I.Q. AND PERFORMANCE POINTS FOR 1957-1958

JUNIOR HIGH SCHOOL BASKETBALL SEASON

SIQ	PL	FGM FGA	FTM FTA	RB	AST	FL	TR	BP	TPP	RK
92	A.	31/69	21/40	57	23	24	7	9	92	1
77	B.	35/105	19/32	57	29	29	8	12	91	2
77	C.	14/45	7/14	34	24	17	4	3	55	5
75	D.	41/138	23/42	34	26	31	6	9	78	4
75	E.	21/72	8/15	37	19	21	10	9	45	7
54	F.	22/84	18/35	36	19	28	5	11	51	6
51	G.	30/123	19/40	40	28	16	6	5	88 1/4	3
44	H.	3/12	5/12	16	13	4	2	1	29	12
28	I.	23/93	9/19	29	8	16	9	13	30 1/4	10
25	J.	19/75	17/58	43	11	33	7	6	32	8
23	K.	4/14	2/5	17	3	8	4	2	11 1/2	13
22	L.	23/84	16/30	26	16	31	9	11	30	11
22	M.	9/30	4/9	11	8	16	4	2	9 1/2	14
8	N.	16/49	13/48	31	17	29	3	4	32	8

NOTE: Abbreviations are the same as those explained in Table I, page 23.

TABLE XII

STATISTICAL ANALYSIS OF TABLE XI USING

PEARSON-PRODUCT MOVEMENT FORMULA

	X	X^2	Y	Y^2	XY
A.	92	8464	92	8464	8464
B.	77	5929	91	8281	7007
C.	77	5929	55	3025	4235
D.	75	5625	78	6084	5850
E.	75	5625	45	2025	3375
F.	54	2916	51	2601	2754
G.	51	2601	88 1/4	7788.06	4500.75
H.	44	1936	29	841	1276
I.	28	784	30 1/4	905.06	847
J.	25	625	32	1024	800
K.	23	529	11 1/2	132.25	264.50
L.	22	484	30	900	660
M.	22	484	9 1/2	90.25	209
N.	8	64	32	1024	256
	673	41995	674 1/2	43184.62	40498.25

$$
\begin{array}{ll}
N\,(\Sigma X)^2 & 587,930 \\
(\Sigma X)^2 & \underline{-452,929} \\
& 135,001
\end{array}
$$

$$
\begin{array}{ll}
N\Sigma Y^2 & 604,584.68 \\
(\Sigma Y)^2 & \underline{-454,950.25} \\
& 149,634.43
\end{array}
$$

$$
\begin{array}{ll}
N\Sigma XY & 566,975.50 \\
\Sigma X\Sigma Y & \underline{-453,938.50} \\
& 113,037.00
\end{array}
$$

$$ r = \frac{113,037}{\sqrt{(135,001)(149,634)}} $$

$$ r = \frac{113,037}{\sqrt{20200739634}} $$

$$ r = .795 \text{ or } .80 $$

There is a correlation of .80 for the 1957-1958 junior high school basketball season using the data presented in Table XI.

Table XIII shows the space I.Q., individual performance points, and total performance points for fourteen players during the 1956-1957 basketball season at Prosser Junior High School, Prosser, Washington. Space I.O. scores range from a low of 6 to a high of 99, total performance points from a low of 6 to a high of 127. Player A, with the highest space I.Q., was first in total performance points. Player N, who had the lowest space I.Q., was in twelfth position. Player G, who had a space I.Q. of 54, in the middle range of space I.Q., was eighth in total performance points.

On the following page, the data presented above will be correlated using the Pearson-Product Movement Formula to determine the correlation between total performance points and space I.Q.

This chapter evaluated the data gathered to determine if any correlation exists between space I.Q. and performance in basketball. By comparing the total performance points with space I.Q., correlations have been found to exist. For the years 1958-1961, on the high school level, correlations of .75, .73, and .57 were found. For the years 1956-1960, on the junior high school level, correlations of .78, .80, .80, and .87 were found.

TABLE XIII

SPACE I.Q. AND PERFORMANCE POINTS FOR 1956-1957

JUNIOR HIGH SCHOOL BASKETBALL SEASON

SIQ	PL	FGM FGA	FTM FTA	RB	AST	FL	TR	BP	TPP		RK
99	A.	48/168	24/48	66	16	22	4	4	127		1
77	B.	16/54	29/47	35	21	17	3	5	76		3
77	C.	19/59	9/20	38	19	12	5	6	61		6
75	D.	24/64	21/40	33	24	22	4	7	69		5
68	E.	13/45	9/16	32	24	9	7	10	52		7
56	F.	23/110	22/41	49	19	14	6	7	81	1/2	2
54	G.	14/42	13/28	21	15	17	3	6	36		8
49	H.	15/81	19/32	46	24	16	6	6	70	3/4	4
35	I.	7/24	8/22	18	9	9	3	4	23		11
25	J.	16/64	18/60	42	8	30	5	8	29		9
22	K.	8/38	6/16	13	14	11	5	10	11	1/2	13
18	L.	17/88	3/12	18	14	21	9	8	6		14
8	M.	20/71	11/36	29	15	25	8	9	26		10
6	N.	1/21	5/18	38	2	6	8	5	18	3/4	12

NOTE: Abbreviations are the same as those explained in Table I, page 23.

TABLE XIV

STATISTICAL ANALYSIS OF TABLE XIII USING

PEARSON-PRODUCT MOVEMENT FORMULA

	X	X^2	Y	Y^2	XY
A.	99	9801	127	16129	12573
B.	77	5929	76	5776	5852
C.	77	5929	61	3721	4697
D.	75	5625	69	4761	5175
E.	68	4624	52	2704	3536
F.	56	3136	81 1/2	6642.25	4564
G.	54	2916	36	1296	1944
H.	49	2401	70 3/4	5005.56	3466.75
I.	35	1225	23	529	805
J.	25	625	29	841	725
K.	22	484	11 1/2	132.25	253
L.	18	324	6	36	108
M.	8	64	26	676	208
N.	6	36	18 3/4	351.56	112.5
	669	43119	687 1/2	48600.62	44019.25

$$
\begin{array}{ll}
N\ (\Sigma X)^2 & 603,666 \\
(\Sigma X)^2 & -447,561 \\
\hline
& 156,105
\end{array}
$$

$$
\begin{array}{ll}
N\Sigma Y^2 & 680,408.68 \\
(\Sigma Y)^2 & -472,656.25 \\
\hline
& 207,752.43
\end{array}
$$

$$
\begin{array}{ll}
N\Sigma XY & 616,269.50 \\
\Sigma X\Sigma Y & -459,937.50 \\
\hline
& 156,332.00
\end{array}
$$

$$ r = \frac{156,332}{\sqrt{(156,105)\ (207,752)}} $$

$$ r = \frac{156,332}{\sqrt{32431125960}} $$

$$ r = .868 \text{ or } .87 $$

There is a correlation of .87 for the 1956-1957 junior high school basketball season using the data presented in Table XIII.

CHAPTER IV

SUMMARY, CONSLUSIONS, AND RECOMMENDATIONS

I. SUMMARY

The purpose of this study was to determine if there is
any correlation between space I.Q. as measured on the SRA Test
and performance in basketball at Prosser Junior High School
during the years 1956-1960 and Prosser High School during the
years 1958-1961.

After evaluating the data gathered and finding the
correlations between total performance points and space I.Q.,
the findings of this study can be divided into two sections;
one for high school and one for junior high school. The
correlations between space I.Q. and performance in basket-
ball for these two groups are as follows:

HIGH SCHOOL

1960-1961------.75

1959-1960------.73

1958-1959------.57

JUNIOR HIGH SCHOOL

1959-1960------.78

1958-1959------.80

1957-1958------.80

1956-1957------.87

From the correlations given above for the high school group, there is an average correlation of .6833 or .68 for the three high school years. There is an average correlation of .8125 or .81 for the four years in the junior high school. The total correlation for all years in this study is .7571 or .76.

II. CONCLUSIONS

1. It appears that there is a measurable relationship between space I.Q. and performance in basketball. This does not preclude the fact that an individual with a low space I.Q. could be a good or one with a high space I.Q. a poor basketball player.

2. The correlation between space I.Q. and performance in basketball according to this study is higher on the junior high school level than on the high school level. Some of the reasons for this difference could be as follows:

a. In the school system in which this study was made, the junior high school is the first place of real training in basketball. Little if any supervised training is given in the grades below this. It is felt that the individuals who do not have either the physical or mental readiness in their first contact with the sport tend to rely more on their mental powers to get them through.

b. Many times in high school, the players have been

playing the game so long that they are prone to make more errors due to lack of interest and enthusiasm. The writer also feels that near the end of basketball season the interest begins to diminish. This is particularly true if the season has been one with more losses than wins.

c. On the high school level, increased pressure from the crowd, generally bigger and more boisterous, often results in a larger number of errors by the players. Many times as the pressure builds, the players revert to poor playing habits which cause many errors. These errors take down the total performance points and lower the correlation between space I.Q. and performance in basketball.

d. Due to the rate of drop out at the high school level and the desire of many students to earn money for cars, etc., the number turning out for basketball is smaller.

e. On the high school level, many players are afraid of the social pressures involved when errors are made and either do not turn out for basketball or are so emotionally upset when playing the game that many errors are made. This is not true in a contact sport such as football because a player is able to take out his frustrations by tackling harder or blocking his man and then going after another player to block.

3. The correlations given here do not necessarily mean causation, but all other factors being equal, it is

felt that there is a direct correlation between space I.Q. and performance in basketball.

III. RECOMMENDATIONS

There seems to be enough evidence of a correlation between space I.Q. and performance in basketball so that this correlation should be used by those teachers and coaches who coach basketball. If the records are available to indicate a score of space I.Q., they can well serve the coaching staff in predicting the future performance of an individual in basketball. This should be very advantageous from a coaching standpoint.

It is further felt that if there is no set of scores available to indicate space I.Q. it would be worth the time and money to order that section of the SRA Test which deals with space I.Q. and give this test to the prospective basketball players. This would involve very little money on the part of the school district and very little time for either the guidance and testing department or the physical education department.

It is further felt that there is sufficient evidence to warrant further study in this area to determine additional factors between performance in basketball and mental ability.

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APPENDIX A

COPY OF SCIENCE RESEARCH ASSOCIATES TEST

SRA PRIMARY MENTAL ABILITIES

INTERMEDIATE—AGES 11-17—FORM AH

VERBAL-MEANING

SPACE **R**EASONING **N**UMBER

WORD-FLUENCY

SRA PRIMARY MENTAL ABILITIES

INTERMEDIATE—AGES 11-17—FORM AH

Prepared by L. L. Thurstone, The University of Chicago *and* Thelma Gwinn Thurstone, Director, Bureau of Child Study of the Chicago Public Schools

You are going to take a series of five tests called the SRA PRI-MARY MENTAL ABILITIES. The purpose of the tests is to find out how well you can solve different kinds of problems. Each of the five tests is important.

It is possible that some of the tests will be more interesting than others; that some will be easier than others; and that some students may do well in one test, and some in another. But you should do the very best you can in every test.

This booklet will be used by many students after you. In order that all of them may have the same chance to make a good score, you are asked to handle the booklet very carefully. Do NOT make marks of any kind on the booklet. Mark your answers ONLY on the Answer Pad.

Read the instructions for each test carefully. Do exactly what they say. Be sure you understand the practice problems before the examiner gives the signal to work the test problems. Listen carefully to the instructions.

The tests are too long to be finished in the time allowed. Work as quickly and as accurately as you can. If you have difficulty with one problem, do not spend too much time on it. Omit it and go on to the next problem.

STOP HERE—DO NOT TURN THE PAGE UNTIL THE EXAMINER TELLS YOU

Please use number 7-231 when reordering this test booklet.

VERBAL-MEANING
PRACTICE EXERCISES

The first word in the following line is **BIG**.

BIG   A. Ill   B. Large   C. Down   D. Sour · · · · · · · · · · · ·

One of the other words means the *same* as BIG. This word is **Large**.
Large is answer B. An ✗ has been marked in **B** on the Answer Pad.

The first word in the following line is **ANCIENT**. Mark an ✗ in the
A, B, C, or **D** box of the word that means the *same* as **ANCIENT**.

ANCIENT   A. Dry   B. Long   C. Happy   D. Old · · · · · · · · · · ·

You should have marked an ✗ in **D**, because **Old** means the
same as **ANCIENT**.

In each of the following problems, mark an ✗ in the box of the
word that means the *same* as the first word. If you wish to change
an answer, draw a circle around this box like ⊗. Then mark the
new answer in the usual way.

QUIET   A. Blue   B. Still   C. Tense   D. Watery · · · · · · · · ·

SAFE   A. Secure   B. Loyal   C. Passive   D. Young · · · · · · · · · · ·

BRAVE   A. Hot   B. Cooked   C. Red   D. Courageous · · · ·

In the first problem, you should have marked **B** for **Still**.
In the second problem, you should have marked **A** for **Secure**.
In the third problem, you should have marked **D** for **Courageous**.

Be sure you understand how to work this kind of problem. When the
examiner gives the signal, you are to work more problems like those
above.

Work quickly, but try not to make mistakes. You will have 4 minutes
for the test. You are not expected to finish in the time allowed.

**STOP HERE—DO NOT TURN THE PAGE UNTIL THE EXAMINER TELLS YOU**

MOIST	A. Curt	B. Humane	C. Damp	D. Moderate
QUICK	A. Major	B. Hasty	C. Narrow	D. Vigorous
ANNUAL	A. Variable	B. Yearly	C. Listless	D. Untenable
SPLENDID	A. Expansive	B. Gay	C. Rigid	D. Excellent
CUSTOMARY	A. Nocturnal	B. Radial	C. Prime	D. Usual
FLUID	A. Livid	B. Dead	C. Liquid	D. Talkative
IDLE	A. Lazy	B. Cross	C. Wild	D. Useful
DESERTED	A. Drab	B. Absurd	C. Disturbed	D. Abandoned

RARE	A. Holy	B. Crass	C. Infrequent	D. Weak
CONTENTED	A. Nasty	B. Continuous	C. Defamatory	D. Satisfied
ENRAGED	A. Pleasing	B. Poor	C. Angry	D. Domestic
BENEFICIAL	A. Artificial	B. Tamable	C. Helpful	D. Piquant
MOLDY	A. Tonic	B. Musty	C. Shapeless	D. Mute
RASPING	A. Harsh	B. Minute	C. Kinaesthetic	D. Marshy
DIETARY	A. Diagrammatic	B. Amorphous	C. Dietetic	D. Grammatical
SOBER	A. Dirty	B. Cloudy	C. Serious	D. Fitting

DROLL	A. Delightful	B. Odd	C. Forceful	D. Foreign
STATELY	A. Dignified	B. Thin	C. Digestible	D. Valid
DISREPUTABLE	A. Shameful	B. Forensic	C. Horticultural	D. Susceptible
GENTEEL	A. Wealthy	B. Urban	C. Polite	D. Ignorant
ORIGINAL	A. Oral	B. Derelict	C. First	D. Reliable
NOVEL	A. Expensive	B. New	C. Gloomy	D. Radical
FAMOUS	A. Celebrated	B. Faithful	C. Renewed	D. Nimble
SYSTEMATIC	A. Laudatory	B. Orderly	C. Jubilant	D. Ambitious
FATIGUED	A. Pliable	B. Grave	C. Weary	D. Fanatic

RESPLENDENT	A. Phonetic	B. Tart	C. Brilliant	D. Fearless
GENEROUS	A. Oblivious	B. Ardent	C. Liberal	D. Defiant
KINGLY	A. Bland	B. Facial	C. Recent	D. Regal
FLEXIBLE	A. Pitiable	B. Formal	C. Pliant	D. Peaceful
SAGACIOUS	A. Exotic	B. Apparent	C. Wise	D. Mild
HEEDLESS	A. Patient	B. Eligible	C. Parallel	D. Rash
DEFICIENT	A. Constant	B. Dreary	C. Lacking	D. Peculiar
VIGILANT	A. Watchful	B. Indulgent	C. Valorous	D. Nascent

MINIMUM	A. Humid	B. Restricted	C. Tranquil	D. Least
GALLANT	A. Chivalrous	B. Authentic	C. Treacherous	D. Probable
GIDDY	A. Feminine	B. Casual	C. Dizzy	D. Comical
DISCREET	A. Caustic	B. Redolent	C. Honorable	D. Prudent
DESTINED	A. Simplified	B. Fated	C. Directional	D. Lucky
ETERNAL	A. Momentous	B. Benign	C. Priceless	D. Perpetual
LAVISH	A. Combined	B. Ribald	C. Worthy	D. Extravagant
DEFECTIVE	A. Concealed	B. Mythical	C. Faulty	D. External

VAGUE	A. Numb	B. Obscure	C. Indecent	D. Vermiculate
ESSENTIAL	A. Classical	B. Indispensable	C. Deplorable	D. Candid
IMPULSIVE	A. Impetuous	B. Petrified	C. Immature	D. Compulsory
DIFFIDENT	A. Fabulous	B. Shy	C. Valuable	D. Alphabetical
ERRONEOUS	A. Solemn	B. False	C. Ironic	D. Tragic
BENEVOLENT	A. Kind	B. Native	C. Suitable	D. Modest
GRIMY	A. Stern	B. Filthy	C. Grim	D. Colorful
LACERATED	A. Disgruntled	B. Mangled	C. Fringed	D. Stricken
INSOLENT	A. Studious	B. Envious	C. Arrogant	D. Accidental

**STOP HERE—DO NOT TURN THE PAGE UNTIL THE EXAMINER TELLS YOU**

PRACTICE EXERCISES

Look at the row of figures below. The first figure is like the letter F. All the other figures are like the first one, but they have been turned in different directions.
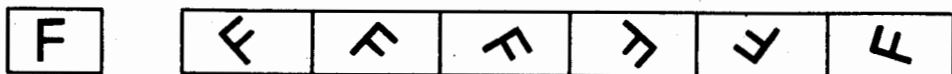
Now look at the next row of figures. The first figure is like the letter F. But none of the other figures looks like an F, even if they were turned right side up. They are all made backward.
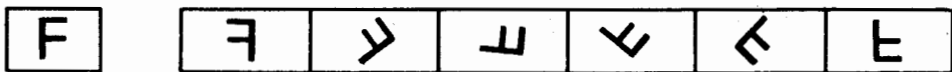
Some of the figures in the next row are like the first figure. Some are made backward.
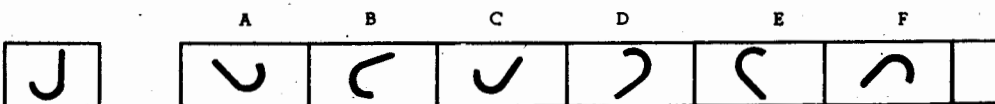
Figures c, E, and F are LIKE the first figure. X's have been marked in C, E, and F on the Answer Pad. Notice that ALL the figures which are LIKE the first figure have been marked.

In the row of figures below, mark an X in the box of EVERY figure which is LIKE the first figure. Do NOT mark the figures which are made backward.
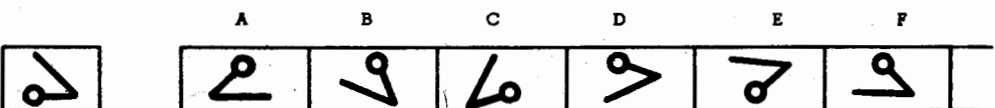
You should have marked an X in A and in E.

In the two rows below, mark an X in the box of EVERY figure which is LIKE the first figure in that row. If you wish to change an answer, draw a circle around this box like ⊗. Then mark the new answer in the usual way.
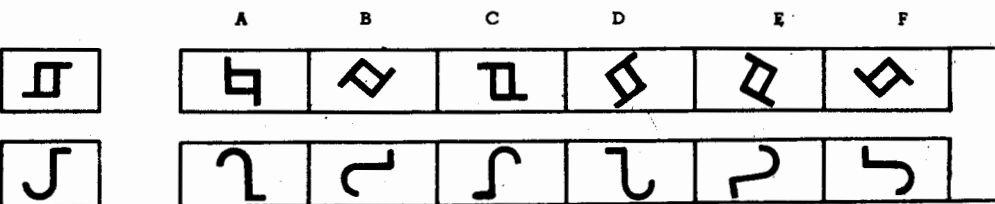
In the first row, you should have marked A, D, and F. In the second row, you should have marked C and F.

Remember that in each row, there may be any number of figures LIKE the first one.

Be sure you understand how to work this kind of problem. When the examiner gives the signal, you are to work more problems like those above.

Work quickly, but try not to make mistakes. You will have 5 minutes for the test. You are not expected to finish in the time allowed.

STOP HERE—DO NOT TURN THE PAGE UNTIL THE EXAMINER TELLS YOU

REASONING

PRACTICE EXERCISES

Study the series of letters below. What letter should come NEXT?

a b a b a b a b

The series goes like this: **ab ab ab ab.** The NEXT letter in the series should be **a.** An ✕ has been marked in ⓐ on the Answer Pad.

Now study the series of letters below. Decide what the NEXT letter should be. Mark an ✕ in the box of the NEXT letter in this series.

c a d a e a f a

The series goes like this: **ca da ea fa.** You should have marked ⓖ.

Now study the series of letters below. In each series, decide what the NEXT letter should be. Mark an ✕ in the box of this letter. If you wish to change an answer, draw a circle around this box like ⊗. Then mark the new answer in the usual way.

c d c d c d

a a b b c c d d

a b x c d x e f x g h x

In the first row, the series goes like this: **cd cd cd.** You should have marked ⓒ.

In the second row, the series goes like this: **aa bb cc dd.** You should have marked ⓔ.

In the third row, the series goes like this: **abx cdx efx ghx.** You should have marked ⓘ.

Now work the following problems for practice. Mark the NEXT letter in each series. Be sure you mark an ✕ in the proper boxes on the Answer Pad at the right.

a a a b b b c c c d d

a x b y a x b y a x b

a b m c d m e f m g h m

r s r t r u r v r w r x r

a b c d a b c e a b c f a b c

In the first row, the series goes like this: **aaa bbb ccc dd.** You should have marked ⓓ.

In the second row, the series goes like this: **axby axby axb.** You should have marked ⓨ.

In the third row, the series goes like this: **abm cdm efm ghm.** You should have marked ⓘ.

In the fourth row, the series goes like this: **rs rt ru rv rw rx r.** You should have marked ⓨ.

In the fifth row, the series goes like this: **abcd abce abcf abc.** You should have marked ⓖ.

Be sure you understand how to work this kind of problem. When the examiner gives the signal, you are to work more problems like those above.

If you come to a problem you cannot work, skip it and go on to the next problem. If you have time, go back again to the hard problems.

Work quickly, but try not to make mistakes. You will have 6 minutes for the test. You are not expected to finish in the time allowed.

STOP HERE—DO NOT TURN THE PAGE UNTIL THE EXAMINER TELLS YOU

a a b c c d e e f g g

a x a y b x b y c x c y d x d

a b c a b c d e f d e f g h i

a b c x y z d e f x y z g h i

a b c a b d a b e a b f

x y z a x y z b x y z c x y z

e f c g h c i j c k l c m n c

c b a c b a c b a c b

a m b c m d e f m g h i j

a a c c e e g g i i

e f e f c d g h g h c d i j

a b b c c c d d d e e e

a b c a b c d a b c d e

a b c c d e f f g h i i j k l

a b a c d c e f e g h g i j

a b c n o d e f n o g h i n o

a b b b c d d d e f f f g h h

h g f e d c b

a c e g i k m

a x b y c z a x b y c z a x b

a b b c d d e f f g h

g h j k m n p q s t v w

a b c a d e f d g h i g j k l

a s b t c u d v e w f x g

a a b b c d d e e f g g h

a a b a b c c d c d e e f

a c f h k m p r

v v v v v w w w w x x x y

a b c c b a d e f f e d g h i

a b c b c d e f e f g h i h

PRACTICE EXERCISES

At the right are two columns of numbers which have been added. Add the numbers for yourself to see if the answers are correct.

A	B
16	42
38	61
45	83
99	176

The A answer is Right, so an X has been marked in ⟦R⟧ on the Answer Pad.

The B answer is Wrong, so an X has been marked in ⟦W⟧ on the Answer Pad.

Now check the sums of the problems below. If the answer is Right, put an X in ⟦R⟧. If the answer is Wrong, put an X in ⟦W⟧. If you wish to change an answer, draw a circle around this box like ⊗. Then mark the new answer in the usual way.

NOT MARK N THE TEST BOOKLET

E SCRATCH APER FOR FIGURING

A	B	C
17	35	63
84	28	17
29	61	89
140	124	169

The A answer is Wrong, so you should have marked ⟦W⟧ on the Answer Pad.

The B answer is Right, so you should have marked ⟦R⟧.

The C answer is Right, so you should have marked ⟦R⟧.

Be sure you understand how to work this kind of problem. When the examiner gives the signal, you are to work more problems like those above.

Work quickly, but try not to make mistakes. You will have 6 minutes for this test. You are not expected to finish in the time allowed. There are TWO pages of test problems.

STOP HERE—DO NOT TURN THE PAGE UNTIL THE EXAMINER TELLS YOU

NUMBER

A	B	C	D	E
61	31	66	73	13
34	59	73	29	39
78	52	15	56	99
53	68	38	33	32
226	200	202	211	183

A	B	C	D	E
48	88	86	69	71
45	29	49	44	37
17	69	54	89	66
82	98	22	84	55
192	284	111	286	129

A	B	C	D	E
44	75	26	99	25
49	54	44	77	46
23	36	75	82	92
48	17	51	68	57
164	162	196	316	220

NOT MARK
THE TEST
BOOKLET

SCRATCH
PAPER FOR
FIGURING

A	B	C	D	E
43	31	59	52	68
34	73	29	56	33
89	13	39	99	32
32	48	45	17	82
198	185	192	124	225

A	B	C	D	E
78	95	79	89	97
56	49	22	64	35
76	44	84	61	66
35	37	55	34	73
245	205	240	258	271

A	B	C	D	E
13	26	44	97	13
92	99	77	92	99
31	26	86	26	86
36	62	68	86	79
172	213	275	201	367

Number

A	B	C	D	E
26	44	75	51	81
77	82	68	39	46
32	84	39	92	43
99	32	57	32	48
234	232	339	314	208

A	B	C	D	E
32	97	23	71	48
98	63	36	46	59
22	76	41	67	17
91	57	65	62	16
243	303	165	236	150

A	B	C	D	E
24	89	26	81	75
85	95	86	39	47
94	55	34	84	55
47	79	99	79	19
250	218	345	293	196

A	B	C	D	E
18	59	64	83	32
15	44	61	34	97
57	78	34	41	23
96	89	19	16	71
186	280	188	174	243

A	B	C	D	E
98	22	91	28	81
63	76	57	63	39
36	41	65	62	67
46	67	62	87	52
243	196	295	260	239

A	B	C	D	E
89	75	51	43	31
86	82	68	73	29
69	99	32	39	99
71	87	23	17	82
315	243	174	182	251

A	B	C	D	E
59	52	68	31	59
56	33	47	43	73
32	55	56	92	43
19	33	58	79	57
146	173	239	245	232

A	B	C	D	E
42	68	75	78	23
29	56	33	47	56
13	39	45	32	55
32	48	99	17	82
106	201	242	154	216

**STOP HERE—DO NOT TURN THE PAGE
UNTIL THE EXAMINER TELLS YOU**

(Left margin, vertical text: SE ATCH PER OR RING)

WORD-FLUENCY

PRACTICE EXERCISES

Look at the words in the list below. Each word begins with *d*.

doll

dinner

daisy

doughnut

You are to write several words which BEGIN with *p*. One word you might write is *pretty*. Turn to the next page, and in the spaces at the TOP of the page on the Answer Pad, write three more words which BEGIN with *p*.

Be sure you understand what you are to do. When the examiner gives the signal, you will be given a new letter. You are to write as many words as you can which begin with the new letter. Any word is all right if it begins with the new letter. If you think of a word that you cannot spell, just spell it the best you can.

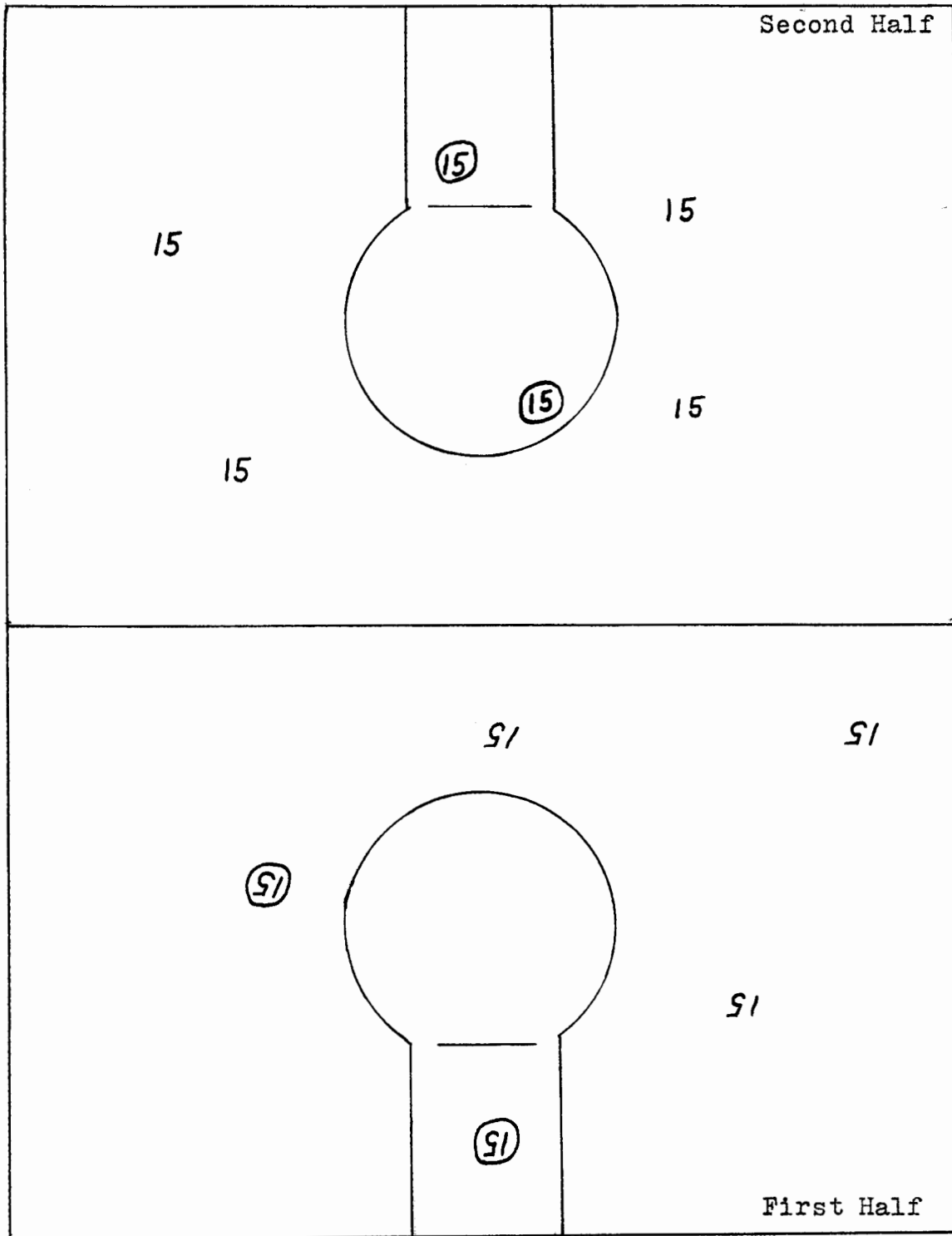Write the words as fast as you can. You will have 5 minutes for the test.

**STOP HERE—DO NOT TURN THE PAGE
UNTIL THE EXAMINER TELLS YOU**

APPENDIX B

COPY OF SHOT CHART USED IN THIS STUDY

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APPENDIX B

SHOT CHART

EXPLANATION OF APPENDIX B

Appendix B shows a copy of the shot chart used in this study. It is the conventional type of shot chart where the number of the player that shoots is placed on the chart as near as possible to the place from which the player shot on the basketball floor. If the player makes the shot, the number is circled. If he does not make the shot, the number is left plain. The chart is divided into two parts, one for each half of the basketball game.

In Appendix B, player 15 shot five times the first half and made two baskets. In the second half, he shot six times and made two baskets.

APPENDIX C

COPY OF CHART USED FOR PERFORMANCE

POINTS IN THIS STUDY

APPENDIX C

CHART FOR REBOUNDING,

TRAVELING, ASSISTS, AND BAD PASSES

R   Rebound   A   Assist

BP   Bad Pass   T   Traveling

FIRST HALF

Smith, J. R A T BP A R R

SECOND HALF

BP R R R A R T

Comments:

EXPLANATION OF APPENDIX C

Appendix C shows the chart used in this study to record traveling, assists, rebounds, and bad passes. This information is kept for each half of the basketball game. There is a section at the bottom of the chart to record information relative to individual players and their habits. For example, if J. Smith was out of position for rebounds each time, this could be noted and the coach would undoubtedly work on this.

In the example used in Appendix A, J. Smith has three rebounds, two assists, one traveling, and one bad pass the first half of this particular basketball game. In the second half, he has four rebounds, one assist, one traveling, and one bad pass.

(Fouls committed, foul shots made and missed, shots made and missed, come from the official score book and the shot chart).