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A Correlation Study of the Sixth Grade Verbal School and College Ability Test with Eighth Grade Reading Achievement

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A CORRELATION STUDY OF THE SIXTH GRADE VERBAL SCHOOL AND COLLEGE ABILITY TEST WITH EIGHTH GRADE READING ACHIEVEMENT

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by

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

THE STUDY AND DEFINITIONS OF TERMS USED

The need for an adequate guidance program in the secondary school has been increasingly more evident. Students must plan early in their school training for a general area of concentration. College requirements are more difficult for pupils to meet each year. It is the counselor's role to help pupils in self-analysis. The counselor must use available information that can provide a sound indication for possible future scholastic activity. However, instruments of known predictive value for many local areas are limited because of the inadequacy of the basic research done to help the student to gain a sufficiently complete understanding of himself and his vocational possibilities.

I. THE SCOPE OF THE STUDY

Purpose of the study. It was the purpose of this study to compare the test scores of one group of children who took the verbal ability section of the sixth grade School and College Ability Test (SCAT) with the test scores of the same group of children on the eighth grade reading Sequential Test of Educational Progress (STEP) and to determine the degree of relationship between the tests.

Hypothesis of the study. The test scores of one

group of children who took the verbal ability section of the sixth grade SCAT will not compare with a significantly positive correlation with test scores of the same group of children on the eighth grade reading STEP.

Importance of the study. At the present time, standardized test results are a main tool for analyzing a student's achievement and scholastic aptitude. It is important for a worker to know his tools well. Teachers appear to be basically well grounded in administering tests, but not when interpreting as to the reliability of the tests. Therefore, the reliability of a test in a local area is important to the teacher or counselor in helping a student plan for the future. The results of this thesis should provide valuable information to junior high school counselors in the Bellevue Public Schools, Bellevue, Washington, who use these tools--the SCAT and STEP.

Table I, located on page 3, indicates the intervals at which the Bellevue Public Schools have used the SCAT and STEP series since 1957. (13:3)

TABLE I

THE BELLEVUE SCAT-STEP TESTING PROGRAM

TEST	GRADE						
ACHIEVEMENT (STEP)	4	5	6	7	8	9	10
Reading	x	x	x		x		x
Mathematics	x	x	x		x		x
Social Studies		x	x		x		x
Science		x	x		x		x
Writing		x	x		x		x
Listening	x	x	x		x		x
GENERAL ABILITY (SCAT)	x	x	x		x		x

II. DEFINITION OF TERMS USED

SCAT. The School and College Ability Test measures achievement of children in certain verbal and quantitative areas and from these results infers verbal and quantitative scholastic aptitude.

STEP. The Sequential Test of Educational Progress measures the student's grasp of the fundamentals of six subjects or skills: reading, writing, mathematics, science, listening, and social studies.

Relationship. Relationship is that particular connection between the SCAT verbal ability section and the reading STEP. The relationship is expressed in the form of a correlation coefficient.

III. LIMITATIONS OF THE STUDY

Teacher evaluation and elementary school grades were not used as part of verbal ability. Junior high school grades were not used as a measure of reading achievement.

IV. ORGANIZATION OF REMAINDER OF STUDY

Chapter II reviews the literature pertaining to the predictive value of tests.

Chapter III is a discussion of the materials used and the groups studied.

Chapter IV gives the results of the comparisons between the two tests.

Chapter V deals with the summary, conclusions, and some suggestions for further study.

CHAPTER II

REVIEW OF THE LITERATURE

Many studies have been conducted attempting to predict achievement of prospective high school students. Some studies correlated ability test results and grade point average. Ross and Hooks brought together a group of correlations showing the relationship between intelligence scores and achievement. The coefficients ranged from .18 to .72, with a median of .39 (10:184-195). Ames obtained a correlation of .71 between achievement and intelligence test scores (3:229-236). Some studies compared achievement test scores from elementary grades at the secondary level. Adams used data derived from administering the National Intelligence Test to pupils in the fourth, fifth, and sixth grades. When these pupils reached college the IQ's derived in the fourth grade correlated .46 with the high school average and .49 with college freshman average. For IQ's obtained in the fifth grade the correlations were .53 and .35; for the sixth grade, .43 and .39 (2:56-66). Aaron showed the median correlation of intelligence and high school scholarship to be .46 when the intelligence test was administered at the elementary school level and .49 when given in the later school years (1:227). Some studies used teachers' judgment of student abilities correlated with later high school grades. Aaron

showed that teachers' marks in algebra provided the best single prediction factor for success in physics (1:227). Layton found a relationship of .82 between eighth grade marks and first-year algebra (7:601-605).

LITERATURE ON THE PREDICTIVE VALUES OF TESTS

In a summary of results from twenty-four studies which reported correlations between high school achievement as a measure of intelligence, Aaron found the correlation coefficient ranged from .25 to .65 with a median of .48 (1:227). Jordan used high school marks compared with four different intelligence test scores with resulting correlations that were similar to those reported by Aaron. The results of Jordan's study were: Otis Quick Scoring Mental Ability Test, correlation .45; Army Alpha, .476; Miller Mental Ability Test, .476; and Terman Group Test, .492 (6:419-429). Pintner found that relationships between scores of intelligence tests and high school marks ranged between a coefficient of .20 to .60 with two below .40 (9:256). The Educational Testing Service conducted a study of seventh grade students in the Newark, Delaware, Central Junior High School. The study compared the SCAT scores taken at the beginning of the year with the STEP scores taken at the end of the school year. The test scores correlated .81 (11:26). All of these comparisons were conducted

with a close interval in time between the mental ability test and the measure of achievement. Layton used a ninth grade achievement test as a predictor of high school twelfth grade achievement. The scores were compared by percentile rank and showed a significant consistency. (8:10)

VALUE AND NEED FOR KNOWING THE PREDICTIVE VALUE OF TESTS

Cain and Michaels state that throughout the educational system promotion implies that the pupil is ready to follow successfully the work of the next higher grade. Consequently, every promotion and every failure is, in a very real sense, a prediction (4:891). Therefore, as a student progresses through school, there is a definite value of and need for valid and reliable measures of the predictive value of tests which are used to estimate the student's ability in a given subject. Cain and Michaels feel that there has been too little concern with followup of prediction. This is particularly true in terms of studies that purport to get at the inherent factors in success and failure (4:891). The accuracy of prediction needs to be more closely checked by investigation of actual later achievement.

CHAPTER III

MATERIALS USED, GROUPS STUDIED, AND METHODS EMPLOYED

I. MATERIALS USED

The SCAT and STEP tests are administered to all Bellevue Public School students starting in grade four and concluding in the tenth school year. The study was only concerned with the SCAT test form 4A that was given during the fall of 1962 to all sixth graders and the STEP reading test form 3A that was administered during the fall of 1964 to the same group of students who were then in the eighth grade.

II. GROUPS STUDIED

A search was made of 1,164 cumulative records from the Bellevue Public Schools to determine which students took the sixth grade verbal ability test form 4A in 1962 and the eighth grade STEP reading form 3A in 1964. During this search a list of 387 female students who took both tests was compiled with their scores.

Consecutive numbers were assigned to all members of the list. Numbers were read vertically from the table of random numbers compiled by Kendall and Smith. When a number from the table corresponded with a number assigned in the

list, that unit was included in the sample. This procedure continued until a sample of one hundred female subjects was compiled.

From a list of 405 male students, a sample of one hundred subjects was procured in the same manner.

III. METHODS EMPLOYED

Statistical analysis was applied to separate male and female groups. All statistical formulas were those used by Edwards (5:72-80).

Tables were set up to employ the techniques necessary for finding a summary of the statistical analysis. A correlation coefficient was found to determine the degree of relationship existing between the SCAT ability scores and the STEP reading scores.

The standard error of estimate was established to ascertain the possible variation between the predicted score on the STEP and the actual achievement.

The two variables were plotted on a graph to determine the trend of the relationship. Since the relationship was linear, a regression equation was used to determine the predicted value of the STEP scores from the SCAT scores.

CHAPTER IV

RESULTS OF THE STUDY

The purpose of the study was to determine the relationship between the sixth grade SCAT and the eighth grade STEP scores. The coefficient of correlation was the statistical device employed. The results were as follows.

Table II indicates the coefficient of correlation for both groups.

TABLE II

COEFFICIENTS OF CORRELATION BETWEEN THE SIXTH GRADE VERBAL SCAT AND EIGHTH GRADE STEP READING

Group	No. of Students	Coefficient of Correlation r
Male	100	.76*
Female	100	.79*

* Significant at the .01 level of confidence.

Employment of the formula for finding the coefficient of correlation revealed a significant positive correlation for the association of both the male and female sixth grade SCAT scores with their eighth grade reading STEP scores. The coefficient of correlation for the sample group of one

hundred boys was .76. The coefficient correlation for the female group of one hundred students revealed a relationship of .79, which was slightly more than the male group. These correlations were interpreted as denoting a high relationship between the two tests.

Table III indicates the standard error of estimate for the samples of one hundred male and female students.

TABLE III

STANDARD ERROR OF ESTIMATE FOR PREDICTED VALUE OF STEP READING SCORES

Group	No. of pupils	Standard Error of Estimate
Male	100	7.75
Female	100	5.87

Standard error of estimate. The standard error of estimate, which indicates the possible variation between the predicted STEP score and the actual individual STEP reading achievement, was calculated. From the sample of one hundred male students the individual STEP score predicted from the SCAT score would be within 7.75 above or below the predicted score. From the sample of one hundred female students the individual STEP score predicted from the SCAT score would be

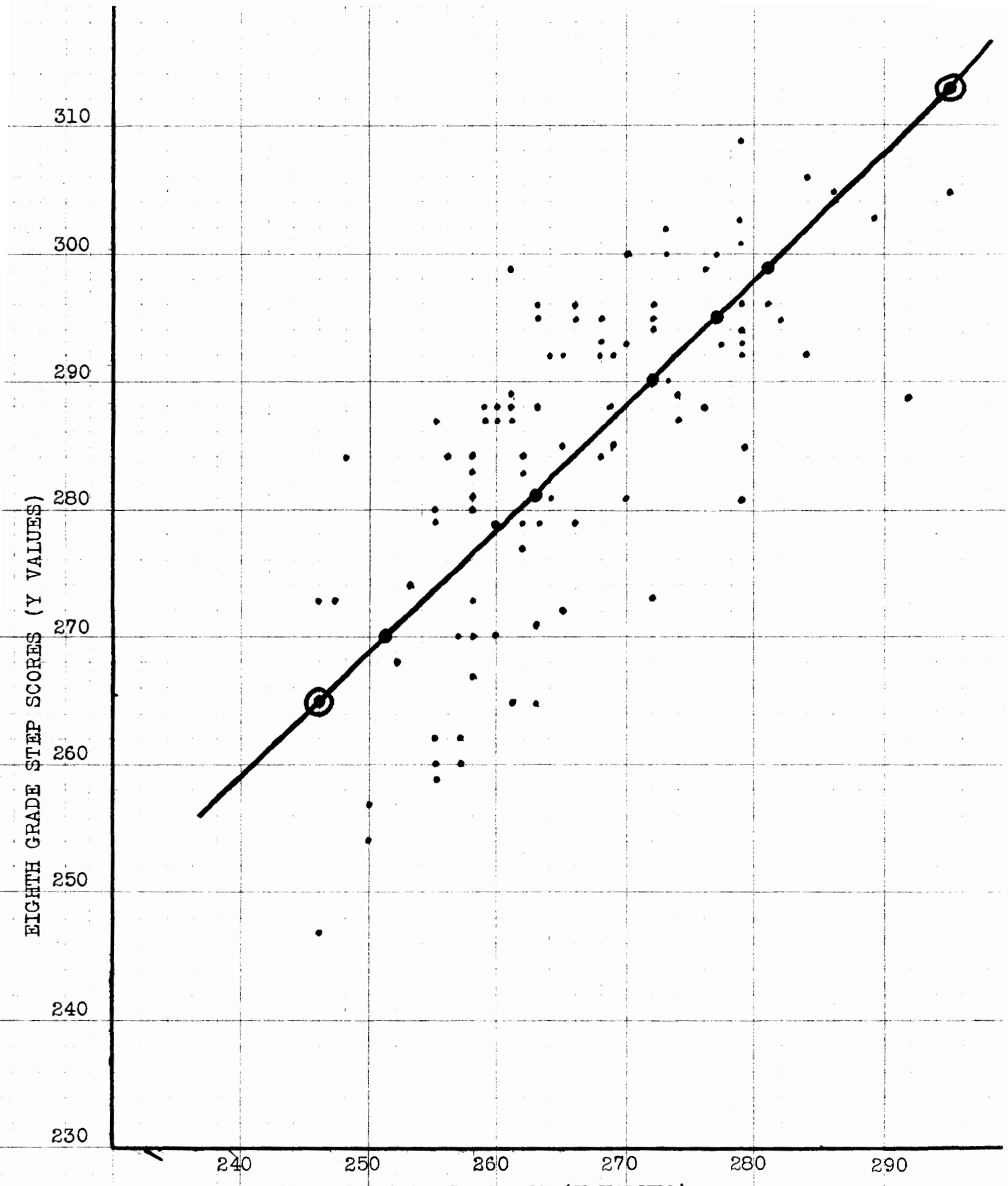

FIGURE 1
PLOTTED SCAT AND STEP SCORES AND THE REGRESSION LINE
DRAWN FROM SCAT SCORES AND PREDICTED STEP SCORES
FOR MALE PUPILS

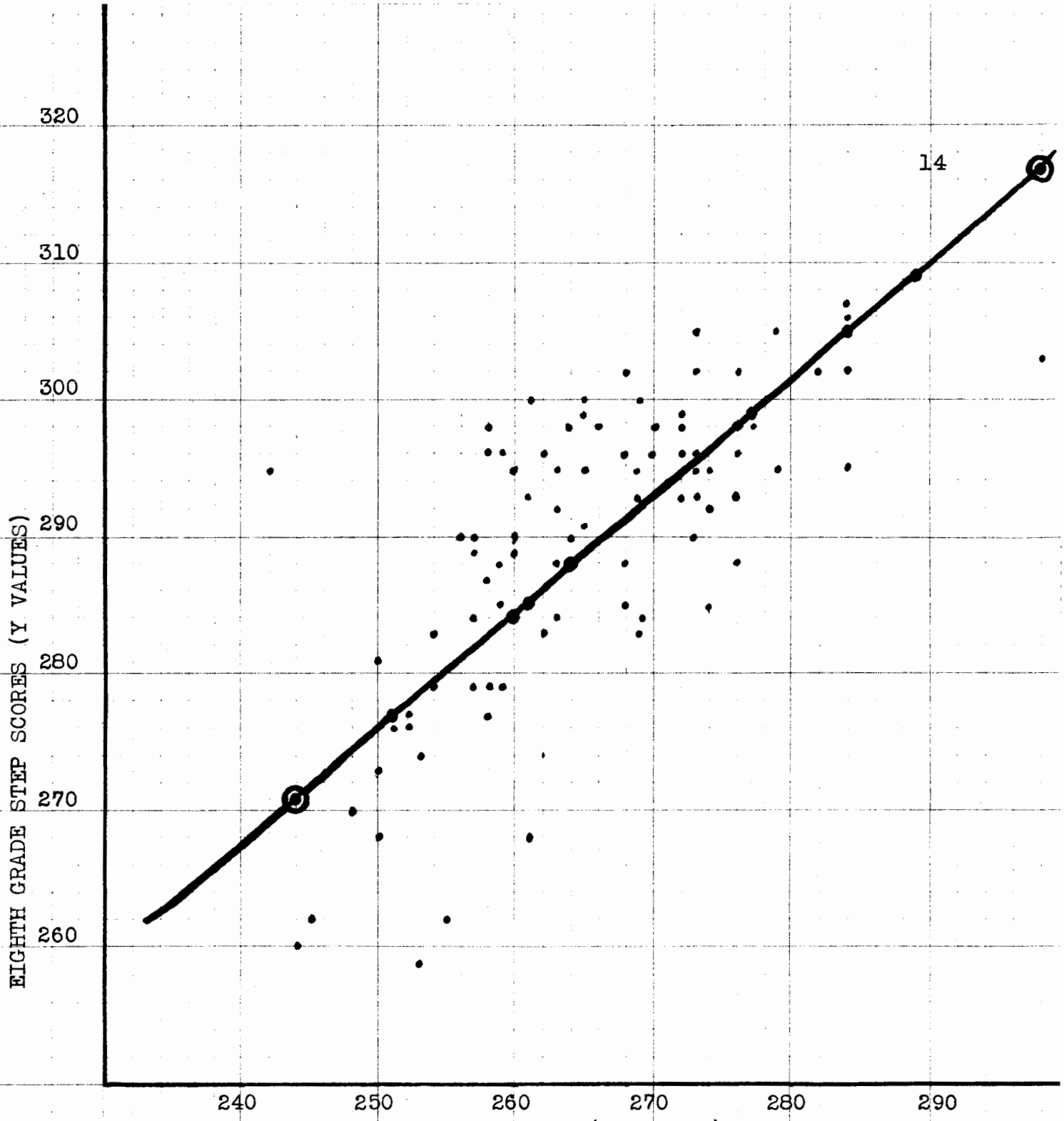

FIGURE 2
PLOTTED SCAT AND STEP SCORES AND THE REGRESSION LINE
DRAWN FROM SCAT SCORES AND PREDICTED STEP SCORES
FOR FEMALE PUPILS

within 5.87 above or below the predicted score.

Regression line of Y on X. The male and female SCAT and STEP scores were plotted on separate graphs to determine the nature of their relationships. Figure 1, located on page 13, illustrates the plotted male SCAT and STEP score. Figure 2, located on page 14, illustrates similar information for the female score.

Both graphs indicated a linear relationship of the SCAT and STEP scores. A correlation coefficient was, therefore, an adequate measure of the association between the two tests.

A regression equation was used to determine the predicted SCAT scores and the predicted STEP scores, which is usually called the regression line, was drawn in each graph. The line drawn in each graph indicated the ideal relationship between the SCAT score and the STEP scores. However, the plotted points did not fall on this line. The discrepancies between the plotted points and the points of the line are explained by the standard error of estimate.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

I. THE SUMMARY

The purpose of this study was to compare the verbal ability of sixth grade students as measured by the SCAT with their eighth grade reading achievement as measured by the reading STEP. The students were selected by a random sample of those who had taken both tests. The comparison was achieved by finding the correlation of the SCAT and STEP scores, the standard error of estimate, and the regression line of Y on X.

The problem of the study was to determine the value of the SCAT as a guidance tool for teachers and counselors when directing students in the selection of high school courses.

II. THE CONCLUSIONS

1. An analysis of the gathered information revealed that there was a statistically significant correlation between the SCAT sixth grade verbal ability test and the STEP eighth grade reading achievement for one group of students in the Bellevue School District.

2. The correlation of the tests was slightly higher for girls than for boys. A review of the male students'

statistics revealed that one student received a lower score on the STEP than on the SCAT. For a sample of one hundred students, this is a possible cause for this difference.

3. The standard error of estimate was slightly less for the female sample than for the male sample. The range of scores on the STEP test was greater for female students than for male students.

4. The SCAT and STEP tests compared more favorably than most similar comparisons as found in previous studies.

5. The SCAT sixth grade verbal test was a reliable predictor of future achievement for the group who took the test in 1964. The hypothesis of this study was that the test scores of one group of children who took the verbal ability section of the sixth grade SCAT would not compare with a significantly positive correlation with test scores of the same group of children on the eighth grade reading STEP. On the basis of these findings, the original hypothesis was rejected.

III. RECOMMENDATIONS

1. The teacher and counselor in the Bellevue Public Schools should use the sixth grade SCAT verbal along with other information as a guidance tool for predicting possible future achievement in reading. If reliable testing information is used properly it can provide a basis for the

teacher and counselor in regrouping, making individual assignments, selection of materials, drill on specific skills, conferences with parents, and as an aid to pupils in evaluating their own progress. One convenient method of keeping these records would be to set up a large looseleaf notebook with a section for every child. These cumulative records can furnish the basis for recommendations made at the end of each school term.

2. The Bellevue School District should continue to use the SCAT and STEP tests for reading. However, it is recommended that further comparisons with similar groups of students be made.

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APPENDICES

APPENDIX A

Tables "B" and "D" use the following symbols:

X	SCAT verbal scores
Y	STEP reading score
X^2	SCAT verbal score squared
Y^2	STEP reading score squared
XY	SCAT score times STEP score
x	SCAT score minus mean of SCAT $(X - \bar{X})$
y	STEP score minus mean of STEP $(X - \bar{Y})$
x^2	(SCAT score minus mean of SCAT) squared
y^2	(STEP score minus mean of STEP) squared
xy	x times y
$\tilde{y}$	b_y times each value of x when b_y equals $\frac{Exy}{Ex^2}$
$y-\tilde{y}$	each y member minus y
$(y-\tilde{y})^2$	(each y member minus y) squared

Formulas used are from Edwards Statistical Analysis (see bibliography)

1. Coefficient of Correlation p. 73 (6.6)
2. Regression Equation p. 78 (6.9, 6.10)
3. Standard Error of Estimate p. 80 (6.11)

MALE SCAT AND STEP SCORES

OBSERVATION	X	Y	X^2	Y^2	XY	x	y
1	246	247	60516	61009	60762	-20.2	-37.9
2	246	273	60516	74529	67158	-20.2	-11.9
3	247	273	61009	74529	67431	-19.2	-11.9
4	248	284	61504	80656	70432	-18.2	- .9
5	250	254	62500	64516	63500	-16.2	-30.9
6	250	257	62500	66049	64250	-16.2	-27.9
7	251	270	63001	72900	67770	-15.2	-14.9
8	252	268	63504	71824	67536	-14.2	-16.9
9	253	274	64009	75076	69322	-13.2	-10.9
10	255	259	65025	67081	66045	-11.2	-25.9
11	255	260	65025	67600	66300	-11.2	-24.9
12	255	262	65025	68644	66810	-11.2	-22.9
13	255	279	65025	77841	71145	-11.2	- 5.9
14	255	280	65025	78400	71400	-11.2	- 4.9
15	255	287	65025	82369	73185	-11.2	2.1
16	256	284	65536	80656	72704	-10.2	- .9
17	257	260	66049	67600	66820	- 9.2	-24.9
18	257	262	66049	68644	67334	- 9.2	-22.9
19	257	270	66049	72900	69390	- 9.2	-14.9
20	258	267	66564	71289	68886	- 8.2	-17.9
21	258	270	66564	72900	69660	- 8.2	-14.9
22	258	273	66564	74529	70434	- 8.2	-11.9
23	258	280	66564	78400	72240	- 8.2	- 4.9
24	258	281	66564	78961	72498	- 8.2	- 3.9
25	258	283	66564	80089	73014	- 8.2	- 1.9
26	258	284	66564	80656	73272	- 8.2	- .9
27	259	287	67081	82369	74592	- 7.2	3.1
28	259	288	67081	82944	74333	- 7.2	2.1
29	259	288	67081	82944	74592	- 7.2	3.1
30	260	270	67600	72900	70200	- 6.2	-14.9
31	260	279	67600	77841	72540	- 6.2	- 5.9
32	260	287	67600	82369	74620	- 6.2	2.1
33	260	288	67600	82944	74880	- 6.2	3.1
34	261	265	68121	70225	69165	- 5.2	-19.9
35	261	287	68121	82369	74907	- 5.2	2.1
36	261	288	68121	82944	75168	- 5.2	3.1
37	261	289	68121	83521	75429	- 5.2	4.1
38	261	299	68121	89401	78039	- 5.2	14.1
39	262	277	68644	76729	72574	- 4.2	- 7.9
40	262	279	68644	77841	73098	- 4.2	- 5.9
41	262	283	68644	80089	74146	- 4.2	- 1.9
42	262	285	68644	81225	74670	- 4.2	.1
43	263	265	69169	70225	69695	- 3.2	-19.9
44	263	271	69169	73441	71273	- 3.2	-13.9
45	263	279	69169	77841	73377	- 3.2	- 5.9
46	263	281	69169	78961	73903	- 3.2	- 3.9
47	263	288	69169	82944	75744	- 3.2	3.1
48	263	295	69169	87025	77585	- 3.2	10.1
49	263	296	69169	87616	77848	- 3.2	11.1
50	264	281	69696	78961	74184	- 2.2	- 3.9

x^2	y^2	xy	$\tilde{y}$	$y-\tilde{y}$	$(y-\tilde{y})^2$
408.04	1436.41	765.58	-19.430	-18.470	338.817649
408.04	141.61	240.38	-19.430	- 7.530	56.700900
368.64	141.61	228.48	-18.469	- 6.569	43.151761
331.24	.81	16.38	-17.507	-16.607	275.792449
262.44	954.81	500.58	-15.583	-15.317	234.610489
262.44	778.41	451.98	-15.583	12.317	151.708489
231.04	222.01	226.48	-14.621	.279	.077841
201.64	285.61	239.98	-13.659	3.241	10.504081
174.24	118.81	143.88	-12.697	- 1.797	3.229209
125.44	670.81	290.08	-10.773	15.127	228.826129
125.44	620.01	278.88	-10.773	14.127	199.572129
125.44	524.41	256.48	-10.773	12.127	147.064129
125.44	34.81	66.08	-10.773	- 4.873	23.746129
125.44	24.01	54.88	-10.773	- 5.873	34.492129
125.44	4.41	-23.52	-10.773	- 8.673	75.220929
104.04	.81	9.18	- 9.811	- 8.911	79.405921
84.64	620.01	229.08	- 8.850	16.050	257.602500
84.64	524.41	210.68	- 8.850	14.050	197.402500
84.64	222.01	137.08	- 8.850	6.050	36.602500
67.24	320.41	146.78	- 7.888	10.012	100.240144
67.24	222.01	122.18	- 7.888	7.012	49.168144
67.24	141.61	97.58	- 7.888	4.012	16.096144
67.24	24.01	40.18	- 7.888	- 2.988	8.928144
67.24	15.21	31.98	- 7.888	- 3.988	15.904144
67.24	3.61	15.58	- 7.888	- 5.988	35.856144
67.24	.81	7.38	- 7.888	- 6.988	48.832144
51.84	9.61	-22.32	- 6.926	- 3.826	14.638276
51.84	4.41	-15.12	- 6.926	- 4.827	23.299929
51.84	9.61	-22.32	- 6.926	- 3.826	14.638276
38.44	222.01	92.38	- 5.964	8.936	79.852096
38.44	34.81	36.58	- 5.964	- .064	.004096
38.44	4.41	-13.02	- 5.964	- 3.864	14.930496
38.44	9.61	-19.22	- 5.964	- 2.864	8.202496
27.04	396.01	103.48	- 5.001	14.899	221.980201
27.04	4.41	-10.92	- 5.001	- 2.901	8.415801
27.04	9.61	-16.12	- 5.001	- 1.901	3.613801
27.04	16.81	-21.32	- 5.001	- .901	.811801
27.04	198.81	-73.32	- 5.001	9.099	82.791801
17.64	62.41	33.18	- 4.040	3.860	14.899600
17.64	34.81	24.78	- 4.040	1.860	3.459600
17.64	3.61	7.98	- 4.040	- 2.140	4.579600
17.64	.01	.42	- 4.040	- 3.940	15.523600
10.24	396.01	63.68	- 3.078	16.822	282.979684
10.24	193.21	44.48	- 3.078	10.822	117.115684
10.24	34.81	18.88	- 3.078	2.822	7.963684
10.24	15.21	12.48	- 3.078	.822	.675684
10.24	9.61	- 9.92	- 3.078	.022	.000484
10.24	102.01	-32.32	- 3.078	7.022	49.308484
10.24	123.21	-35.52	- 3.078	8.022	64.352484
4.84	15.21	8.58	- 2.117	1.783	3.179089

OBSERVATION	X	Y	X^2	Y^2	XY	x	y
51	264	292	69696	85264	77088	-2.2	7.1
52	265	274	70225	75076	72610	-1.2	-10.9
53	265	285	70225	81225	75525	-1.2	.1
54	265	292	70225	85264	77380	-1.2	7.1
55	266	279	70756	77841	74214	- .2	- 5.9
56	266	295	70756	87025	78470	- .2	10.1
57	266	296	70756	87616	78736	- .2	11.1
58	268	284	71824	80656	76112	1.8	- .9
59	268	292	71824	85264	78256	1.8	7.1
60	268	293	71824	85849	78524	1.8	8.1
61	268	295	71824	87025	79060	1.8	10.1
62	269	285	72361	81225	76665	2.8	.1
63	269	288	72361	82944	77472	2.8	3.1
64	269	292	72361	85264	78548	2.8	7.1
65	270	281	72900	78961	75870	3.8	- 3.9
66	270	293	72900	85849	79110	3.8	8.1
67	270	300	72900	90000	81000	3.8	15.1
68	272	273	73984	74529	74256	5.8	-11.9
69	272	290	73984	84100	78880	5.8	5.1
70	272	294	73984	86436	79968	5.8	9.1
71	272	295	73984	87025	80240	5.8	10.1
72	272	296	73984	87616	80512	5.8	11.1
73	273	290	74529	84100	79170	6.8	5.1
74	273	300	74529	90000	81900	6.8	15.1
75	273	302	74529	91204	82446	6.8	17.1
76	274	287	75076	82369	78638	7.8	2.1
77	274	289	75076	83521	79186	7.8	4.1
78	276	288	76176	82944	79488	9.8	3.1
79	276	299	76176	89401	82524	9.8	14.1
80	277	293	76729	85849	81161	10.8	8.1
81	277	295	76729	87025	81715	10.8	10.1
82	277	300	76729	90000	83100	10.8	15.1
83	279	281	77841	78961	78399	12.8	- 3.9
84	279	285	77841	81225	79515	12.8	.1
85	279	292	77841	85264	81468	12.8	7.1
86	279	293	77841	85849	81747	12.8	8.1
87	279	294	77841	86436	82026	12.8	9.1
88	279	296	77841	87616	82584	12.8	11.1
89	279	301	77841	90601	83979	12.8	16.1
90	279	303	77841	91809	84537	12.8	18.1
91	279	309	77841	95481	86211	12.8	24.1
92	281	296	78961	87616	83176	14.8	10.1
93	281	299	78961	89401	84019	14.8	14.1
94	282	295	79524	87025	83190	15.8	10.1
95	284	292	80656	85264	82928	17.8	7.1
96	284	306	80656	93636	86904	17.8	21.1
97	286	305	81796	93025	87230	19.8	20.1
98	289	303	83521	91809	87567	22.8	18.1
99	292	289	85264	83521	84388	25.8	4.1
100	295	305	87025	93025	89975	28.8	20.1
TOTAL	26622	28487	7098392	8131347	7593565		

Mean of X 266.2 Mean of Y 284.9

x^2	y^2	xy	$\tilde{y}$	$y-\tilde{y}$	$(y-\tilde{y})^2$
4.84	50.41	-15.62	-2.117	8.783	77.141089
1.44	118.81	13.08	-1.154	9.746	94.984516
1.44	.01	- .12	-1.154	-1.054	1.110916
1.44	50.41	- 8.52	-1.154	5.946	35.354916
.04	34.81	1.18	- .192	5.708	32.581264
.04	102.61	- 2.02	- .192	9.908	98.168464
.04	123.21	- 2.22	- .192	10.908	118.984464
3.24	.81	- 1.62	1.731	- .831	.690561
3.24	50.41	12.78	1.731	5.369	28.826161
3.24	65.61	14.58	1.731	6.369	40.564161
3.24	102.01	18.18	1.731	8.369	70.040161
7.84	.01	.28	2.693	-2.593	6.723649
7.84	9.61	8.68	2.693	.407	.165649
7.84	50.41	19.88	2.693	4.407	19.421649
14.44	15.21	-14.82	3.655	.245	.060025
14.44	65.61	30.78	3.655	4.445	19.758025
14.44	228.01	57.38	3.655	11.445	130.988025
33.64	141.61	-69.02	5.579	6.321	39.955041
33.64	26.01	29.58	5.579	- .479	.229441
33.64	82.81	52.78	5.579	3.521	12.397441
33.64	102.01	58.58	5.579	4.521	20.439441
33.64	123.21	64.38	5.579	5.521	30.481441
46.24	26.01	34.68	6.541	-1.441	2.076481
46.24	228.01	102.68	6.541	8.559	73.256481
46.24	292.41	116.28	6.541	10.559	111.492481
60.84	4.41	16.38	7.503	-5.403	29.192409
60.84	16.81	31.98	7.503	-3.403	11.580409
96.04	9.61	30.38	9.427	-4.403	19.386409
96.04	198.81	138.18	9.427	4.673	21.836409
116.64	65.61	87.48	10.389	-2.289	5.239521
116.64	102.01	109.08	10.389	- .289	.083521
116.64	228.01	163.08	10.389	4.711	22.193521
163.84	15.21	-49.91	12.312	-8.412	70.761744
163.84	.01	1.28	12.312	-12.212	149.132944
163.84	50.41	90.88	12.312	-5.212	27.164944
163.84	65.61	103.68	12.312	-4.212	17.740944
163.84	82.81	116.48	12.312	-3.212	10.316944
163.84	123.21	142.08	12.312	-1.212	1.468944
163.84	259.21	206.08	12.312	3.788	14.348944
163.84	327.61	231.68	12.312	5.788	33.500944
163.84	580.81	308.48	12.312	11.788	138.956944
219.04	102.01	149.48	14.236	-4.136	17.106496
219.04	198.81	208.68	14.236	- .136	.018496
249.64	102.01	159.58	15.198	-5.098	25.989604
316.84	50.41	126.38	17.122	-10.022	100.440484
316.84	445.21	375.58	17.122	3.978	15.824484
392.04	404.01	397.98	19.046	1.054	1.110916
519.84	327.61	412.68	21.931	-3.831	14.676561
665.64	16.81	105.78	21.931	-17.831	317.944561
829.44	404.01	578.88	27.703	-7.603	57.805609
11,083.20	16,234.80	10,661.52			5896.489787

APPENDIX C

Coefficient of Correlation for Male Students:

$$r = \frac{EXY - \frac{(EX)(EY)}{n}}{\sqrt{\left(EX^2 - \frac{(EX)^2}{n}\right)\left(EY^2 - \frac{(EY)^2}{n}\right)}}$$

$$r = .762017$$

Standard Error of Estimate for Male Students:

$$S_{y.x} = \sqrt{\frac{E(y-y)^2}{n-2}} = 7.75682$$

Regression of Y on X for Male Students:

$$b_y = \frac{Exy}{Ex^2} = .9619$$

$$\tilde{y} = b_{yx} \quad \text{(x for each of its values)}$$

The regression line was drawn by using observation #1 (X score 246) and its corresponding Y score 247 - $(y-\tilde{y})$ = 247 - (18.470) = 265.470. Therefore, the first point plotted was X = 246, Y = 265.470. The second point plotted used observation #100 (X score 295) and its corresponding Y score 305 - $(y-\tilde{y})$ = 305 - (7.603) = 312.603. Therefore, the second point plotted was X = 295, Y = 312.603. The regression line was drawn between these two points. However, any two observations could be used to determine this same line.

FEMALE SCAT AND STEP SCORES

OBSERVATION	X	Y	X^2	Y^2	XY	x	y
1	244	260	59536	67600	63440	-21.8	-30
2	244	295	59536	87025	71980	-21.8	5
3	245	262	60025	68644	64190	-20.8	-28
4	248	270	61504	72900	66960	-17.8	-20
5	250	268	62500	71824	67500	-15.8	-22
6	250	273	62500	74529	68250	-15.8	-17
7	250	281	62500	78961	70250	-15.8	- 9
8	251	276	63001	76176	69276	-14.8	-14
9	251	277	63001	76729	69527	-14.8	-13
10	252	276	63504	76176	69552	-13.8	-14
11	252	276	63504	76176	69552	-13.8	-14
12	252	277	63504	76729	69804	-13.8	-13
13	253	259	64009	67081	65527	-12.8	-31
14	253	274	64009	75076	69322	-12.8	-16
15	254	279	64516	77841	70866	-11.8	-11
16	254	283	64516	80089	71882	-11.8	- 7
17	255	262	65025	68644	66810	-10.8	-28
18	256	290	65536	84100	74240	- 9.8	.0
19	257	279	66049	77841	71703	- 8.8	-11
20	257	284	66049	80656	72988	- 8.8	- 6
21	257	289	66049	83521	74273	- 8.8	- 1
22	257	290	66049	84100	74530	- 8.8	.0
23	258	277	66564	76729	71466	- 7.8	-13
24	258	279	66564	77841	71982	- 7.8	-11
25	258	287	66564	82369	74046	- 7.8	- 3
26	258	296	66564	87616	76368	- 7.8	6
27	258	298	66564	88804	76884	- 7.8	8
28	259	279	67081	77841	72261	- 6.8	-11
29	259	285	67081	81225	73815	- 6.8	- 5
30	259	288	67081	82944	74592	- 6.8	- 2
31	259	296	67081	87616	76664	- 6.8	6
32	260	284	67600	80656	73840	- 5.8	- 6
33	260	289	67600	83521	75140	- 5.8	- 1
34	260	290	67600	84100	75400	- 5.8	.0
35	260	295	67600	87025	76700	- 5.8	5
36	261	268	68121	71824	69948	- 4.8	-22
37	261	285	68121	81225	74385	- 4.8	- 5
38	261	293	68121	85849	76473	- 4.8	3
39	261	293	68121	85849	76473	- 4.8	3
40	261	300	68121	90000	78300	- 4.8	10
41	262	274	68644	75076	71788	- 3.8	-16
42	262	283	68644	80089	74146	- 3.8	- 7
43	262	296	68644	87616	77552	- 3.8	6
44	263	284	69169	80656	74692	- 2.8	- 6
45	263	288	69169	82944	75744	- 2.8	- 2
46	263	292	69169	85264	76796	- 2.8	2
47	263	295	69169	87025	77585	- 2.8	5
48	264	288	69696	82944	76032	- 1.8	- 2
49	264	290	69696	84100	76560	- 1.8	.0
50	264	298	69696	88804	78672	- 1.8	8

x^2	y^2	xy	$\tilde{y}$	$y-\tilde{y}$	$(y-\tilde{y})^2$
475.24	900.	654.0	-18.768	11.232	126.157764
475.24	25.	-109.0	-18.768	-13.767	189.530289
432.64	784.	582.4	-17.907	10.093	101.868649
316.84	400.	356.0	-15.324	4.676	21.864976
249.64	484.	347.6	-13.602	8.398	70.526404
249.64	289.	268.6	-13.602	3.398	11.546404
249.64	81.	142.2	-13.602	- 4.602	21.178404
219.04	196.	207.2	-12.741	1.259	1.585081
219.04	169.	192.4	-12.741	.259	.067081
190.44	196.	193.2	-11.880	2.120	4.494400
190.44	196.	193.2	-11.880	2.120	4.494404
190.44	169.	179.4	-11.880	1.120	1.254400
163.84	961.	396.8	-11.020	19.980	399.200400
163.84	256.	204.8	-11.020	4.980	24.800400
139.24	121.	129.8	-10.159	.841	.707281
139.24	49.	82.6	-10.159	- 3.159	9.979281
116.64	784.	302.4	- 9.298	18.702	349.764804
96.04	0.	0.0	- 8.437	8.437	71.182969
77.44	121.	96.8	- 7.576	3.424	11.723776
77.44	36.	52.8	- 7.576	- 1.576	2.483776
77.44	1.	8.8	- 7.576	- 6.576	43.243776
77.44	0.	0.0	- 7.576	7.576	57.395776
60.84	169.	101.4	- 6.715	6.285	39.501225
60.84	121.	85.8	- 6.715	4.285	18.361225
60.84	9.	23.4	- 6.715	- 3.715	13.801225
60.84	36.	46.8	- 6.715	- .715	.511225
60.84	64.	- 62.4	- 6.715	1.285	1.651225
46.24	121.	74.8	- 5.854	5.146	26.481316
46.24	25.	34.0	- 5.854	- .854	.729316
46.24	4.	13.6	- 5.854	- 3.854	14.853316
46.24	36.	- 40.8	- 5.854	.146	.021316
33.64	36.	34.8	- 4.993	- .146	.021316
33.64	1.	5.8	- 4.993	- 3.993	15.944049
33.64	0.	0.0	- 4.993	- 4.993	24.930049
33.64	25.	- 29.0	- 4.993	.007	.000049
23.04	484.	105.6	- 4.132	17.868	319.265424
23.04	25.	24.0	- 4.132	.868	.753424
23.04	9.	- 14.4	- 4.132	- 3.132	9.809424
23.04	9.	- 14.4	- 4.132	- 3.132	9.809424
23.04	100.	- 48.0	- 4.132	5.868	34.433424
14.44	256.	60.8	- 3.271	12.729	162.027441
14.44	49.	26.6	- 3.271	3.729	13.905441
14.44	36.	22.8	- 3.271	2.729	7.447441
7.84	36.	16.8	- 2.411	3.589	12.880921
7.84	4.	- 5.6	- 2.411	- .411	.168921
7.84	4.	- 5.6	- 2.411	- .411	.168921
7.84	25.	- 14.4	- 2.411	2.589	6.702921
3.24	4.	3.6	- 1.550	.450	.202500
3.24	0.	0.0	- 1.550	- 1.550	2.402500
3.24	64.	- 14.4	- 1.550	6.450	41.602500

OBSERVATION	X	Y	X^2	Y^2	XY	x	y
51	265	292	70225	85264	77380	- .8	2
52	265	295	70225	87025	78175	- .8	5
53	265	299	70225	89401	79235	- .8	9
54	265	300	70225	90000	79500	- .8	10
55	266	298	70756	88804	79268	.2	8
56	268	285	71824	81225	76380	2.2	-5
57	268	288	71824	82944	77184	2.2	-2
58	268	296	71824	87616	79328	2.2	6
59	268	302	71824	91204	80936	2.2	12
60	269	283	72361	80089	76172	3.2	-7
61	269	284	72361	80656	76396	3.2	-6
62	269	293	72361	85849	78817	3.2	3
63	269	295	72361	87025	79355	3.2	5
64	269	300	72361	90000	80700	3.2	10
65	270	296	72900	87616	79920	4.2	6
66	270	298	72900	88804	80460	4.2	8
67	272	293	73984	85849	79696	6.2	3
68	272	296	73984	87616	80512	6.2	6
69	272	298	73984	88804	81056	6.2	8
70	272	299	73984	89401	81328	6.2	9
71	273	290	74529	84100	79170	7.2	.0
72	273	293	74529	85849	79989	7.2	3
73	273	293	74529	85849	79989	7.2	3
74	273	295	74529	87025	80535	7.2	5
75	273	296	74529	87616	80808	7.2	6
76	273	302	74529	91204	82446	7.2	12
77	273	305	74529	93025	83265	7.2	15
78	274	285	75076	81225	78090	8.2	-5
79	274	292	75076	85164	80008	8.2	2
80	274	295	75076	87025	80830	8.2	5
81	274	295	75076	87025	80830	8.2	5
82	276	288	76176	82944	79488	10.2	-2
83	276	293	76176	85849	80868	10.2	3
84	276	296	76176	87616	81696	10.2	6
85	276	298	76176	88804	82248	10.2	8
86	276	302	76176	91204	83352	10.2	12
87	277	298	76729	88804	82546	11.2	8
88	277	299	76729	89401	82823	11.2	9
89	279	295	77841	87025	82305	13.2	5
90	279	305	77841	93025	85095	13.2	15
91	282	302	79524	91204	85164	16.2	12
92	284	295	80656	87025	83780	18.2	5
93	284	302	80656	91204	85768	18.2	12
94	284	302	80656	91204	85768	18.2	12
95	284	305	80656	93025	86620	18.2	15
96	284	306	80656	93636	86904	18.2	16
97	284	307	80656	94249	87188	18.2	17
98	289	309	83521	85481	89301	23.2	19
99	289	309	83521	95481	89301	23.2	19
100	298	303	88804	91809	90204	32.2	13
	26575	28995	7074093	8419359	7714993		

$\bar{X}$ 265.8

$\bar{Y}$ 290.0

x^2	y^2	xy	$\tilde{y}$	$y-\tilde{y}$	$(y-\tilde{y})$
.64	4.	- 1.6	- .689	1.311	1.718721
.64	25.	- 4.0	- .689	4.311	18.584721
.64	81.	- 7.2	- .689	8.311	69.072721
.64	100.	- 8.0	- .689	9.311	86.684721
.04	64.	1.6	.172	7.828	61.277584
4.84	25.	- 11.0	1.894	3.106	9.647236
4.84	4.	- 4.4	1.894	.106	.011236
4.84	36.	13.2	1.894	4.106	16.859236
4.84	144.	26.4	1.894	9.245	85.470025
10.24	49.	- 22.4	2.755	4.245	18.020025
10.24	36.	- 19.2	2.755	3.245	10.530025
10.24	9.	9.6	2.755	.245	.060025
10.24	25.	16.0	2.755	2.245	5.040025
10.24	100.	32.0	2.755	7.245	52.490025
17.64	36.	25.2	3.616	2.384	5.683456
17.64	64.	33.6	3.616	4.384	19.219456
38.44	9.	18.6	5.338	- 2.338	5.466244
38.44	36.	37.2	5.338	.662	.438244
38.44	64.	49.6	5.338	2.662	7.086224
38.44	81.	55.8	5.338	3.662	13.410224
51.84	0.	0.0	6.119	- 6.199	38.427601
51.84	9.	21.6	6.119	- 3.199	10.233601
51.84	9.	21.6	6.119	- 3.199	10.233601
51.84	25.	36.0	6.119	- 1.199	1.637601
51.84	36.	43.2	6.119	- .199	.039601
51.84	144.	86.4	6.119	5.801	33.651601
51.84	225.	108.0	6.119	8.801	33.651601
67.24	25.	- 41.0	7.059	- 2.059	4.239481
67.24	4.	16.4	7.059	- 5.059	25.593481
67.24	25.	41.0	7.059	- 2.059	4.239481
67.24	25.	41.0	7.059	- 5.059	25.593481
104.04	4.	- 20.4	8.781	- 6.781	45.981961
104.04	9.	30.6	8.781	- 5.781	33.419961
104.04	36.	61.2	8.781	- 2.781	7.733961
104.04	64.	81.6	8.781	- .781	.609961
104.04	144.	122.4	8.781	3.219	10.361961
125.44	64.	89.6	9.624	- .781	.609961
125.44	81.	100.8	9.624	- 3.364	11.316496
174.24	25.	66.0	11.364	- 2.364	5.588496
174.24	225.	198.0	11.364	3.636	13.220496
262.44	144.	194.4	13.947	- 1.947	3.790809
331.24	25.	91.0	15.668	-10.668	113.806224
331.24	144.	218.4	15.668	- 3.688	13.601344
331.24	144.	218.4	15.668	- 3.688	13.601344
331.24	225.	273.0	15.668	- .688	.473344
331.24	256.	291.2	15.668	- .332	.110224
331.24	289.	309.4	15.668	1.332	1.774224
538.24	361.	440.8	19.973	- .973	.946729
538.24	361.	440.8	19.973	- .973	.946729
1036.84	169.	418.6	27.721	-14.721	216.707841
11787.04	12259.00	10148.6			3467.156116

APPENDIX E

Coefficient of Correlation for Female Students:

$$r = \frac{EXY - \frac{(EX)(EY)}{n}}{\sqrt{\left(EX^2 - \frac{(EX)^2}{n}\right)\left(EY^2 - \frac{(EY)^2}{n}\right)}}$$

$$r = .796290$$

Standard Error of Estimation for Female Students:

$$S_{y.x} = \sqrt{\frac{E(y-\tilde{y})^2}{n-2}} = 5.87118$$

$$=$$

Regression of Y on X for Female Students:

$$b_y \quad \frac{Exy}{Ex^2} \quad .8609$$

$$\tilde{y} \quad b_y x \quad (x \text{ for each of its values})$$

The regression line was drawn by using observation #1 (X score 244) and its corresponding Y score 260 - $(y-\tilde{y})$ = 260 - (11.232) = 271.232. Therefore, the first point plotted was X - 244, Y - 271.232. The second point plotted used observation #100 (X score 298) and its corresponding Y score 303 - $(y-\tilde{y})$ = 303 - (14.721) = 317.721. Therefore, the second point plotted was X = 298, Y = 317.721. The regression line was drawn between these two points. However, any two observations could be used to determine this same line.