AN EVALUATION OF STATISTICAL TERMS, FORMULAE GRAPHS, AND TABLES USED IN RESEARCH

by

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I. INTRODUCTION

A. The Problem

Having been rather closely associated with the subject of mental and achievement measuring in college, in research work, and in the practical application, the question presented itself as to part of the statistical terms, formulae, graphs, and tabular representations taught in the mental measurement classes of the different colleges, were actually being used by the students in their research work. After the accumulation of these data the writer hopes to be able to evaluate these terms, formulae, graphs, and tabular representations as to major and minor importance and to determine which should be given the major emphasis by both the teacher and the student in the mental measurement classes in the future.

B. Procedure

In order to arrive at a satisfactory conclusion on the problem as previously stated, it was necessary to get both the theoretical and the practical viewpoint. By using a glossary[1] of three hundred terms used in educational research

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[1] C. W. Odell, A Glossary of Three Hundred Terms Used in Research.

and measurement as the criterion, a satisfactory foundation was layed to obtain the desired data. A thorough examination was made of twenty-one of the leading texts in the field of mental and achievement measuring to determine what was actually being taught by the different colleges in this field, and a chart made of the texts examined with the frequency of occurrence of each of the three hundred terms, formulae, graphic and tabular representation used in research work.[1] The possible grouping of these terms into major and minor classifications as to frequency of occurrence was watched very closely. The number of times that each author used each of the terms, formulae, tables, and graphs, the total number of times each term was used by all the authors combined, the total of all the terms used by all of the authors, and the total of all the terms used by each of the authors were recorded.[2] Following this came the examination of twenty-one masters and doctors theses from Chicago and Columbia Universities to determine the extent to which these terms as taught were actually being used in research work. These data were compiled and recorded on a large chart[3]

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1 See Table page 63

2 See Table page 63

3 See Chart page 63

listing the theses, the author, and the frequency of occurrence of the different mental measurement terms, formulae, graphic, and tabular representation, the number of times each term was used by each one of the authors, the total number of times each term was used by all the authors, the total of all the terms used by each of the authors and the total number of times all the authors used all the terms.[1] In addition to the examination of these texts and theses, twenty magazine articles and eight surveys were examined to determine what was being used in practical application of what was learned in the mental measurement courses, and the same method of tabulation was used as previously mentioned. From these data the relationship was determined between the terms, formulae, graphic, and tabular representations emphasized in the mental measurement courses and those same terms, formulae, graphic, and tabular representations actually used in research work,[2] by classifying them into two classes, as majors and minors, in respect to their frequency of occurrence. This was done by placing all the terms, formulae, tables, and graphs used by at least fifty per cent of the

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[1] See table page 63

[2] See table page 63

textbook authors in the major class and those under fifty per cent in the minor class. If these major terms, formulae, graphs, and tables were used by approximately fifty per cent of the theses writers, that was considered sufficient proof to warrant their being classified as major terms used in research. The surveys were classified in approximately the same manner and then a general conclusion was arrived at and specific terms were recommended as being used sufficient to warrant their being taught to students of research work.

II. RESULTS OBTAINED FROM TEXT BOOKS

A. Measures Of Central Tendency

1. The Mean. In determining the frequency of occurrence of the measures of central tendency, namely, the mean, the median, and the mode, the texts of twenty-one of the leading authors in the field of mental and achievement measurement, were read and thoroughly checked for these terms. This investigation showed that the mean as a measure of central tendency, was used more frequently than any of the other measures, being used consistently by each of the twenty-one authors with a grand total of times used being eight hundred and forty-nine.[1] These authorities did not use the term, mean, in all instances as the terms mean, average, and arithmetic mean were used interchangeably, with the term, average, being used most frequently with a total of five hundred and forty-nine occurrences. This may be accounted for by the fact that the word average may be used more generally than the others, making the term, mean, preferable as it has a more specific use and the average may be saved for more inclusive use, and much confusion avoided. The arithmetic mean was used less frequently than the others,

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[1] See table page 7

having been used only eighty-five times, because of the trend toward standardization of statistical terms used, and a desire for simplicity. In recent years the mean has become quite popular for statistical use owing to the development of methods of computing which greatly reduced the amount of labor involved.[1] The mean will readily be recognized as the so-called average which is usually taught in the fifth grade of the elementary schools. The mean is commonly defined as the value resulting from the dividing the sum of the measures under consideration by the number of such measures. In more recent developments in mental measurement it has come to mean a point on the scale such that the sum of the deviation above it is exactly equal to the sum of the deviation below it. The mean is to be used when every score should have an influence in determining the average or when the lowest unreliability is sought.[2] It is greatly effected by extreme cases and for that reason should many times give way to the use of the median or the mode. It is found by dividing the sum of scores by their number as in the formula

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[1] H. A. Greene, Workbook in Mental Measurement. p. 15.

[2] W. A. McCall, How To Measure In Education. p. 377.

TABLE I

MEASURES OF CENTRAL TENDENCY AS TO FREQUENCY OF OCCURRENCE

Text Book Author	Mean	Median	Mode	Total
Green and Jorgensen	14	18	1	33
Monroe, Devoss & Kelly	16	17	0	33
B. R. Buckingham	20	11	5	36
M.R.Trabue	75	28	13	116
T.L.Kelly	53	9	0	62
W.A.McCall	61	31	0	92
H.O.Rugg	64	25	16	105
H.O.Rugg	86	26	15	127
E.M.Paulu	6	23	0	29
S.L.Pressey	13	31	0	44
C.A.Gregory	72	27	8	107
Smith and Wright	33	14	2	49
L.M.Terman	42	10	0	52
Wilson and Hoke	25	33	1	59
F.N.Freeman	40	18	7	65
W.S.Monroe	31	24	0	55
Stoddard & G.M.Ruch	29	21	0	50
P.M.Symonds	47	8	0	55
W.S.Monroe	20	12	0	32
G.M.Ruch	50	11	1	62
H.A.Greene	52	31	0	83

The Median.[1] The data brought out the fact that the median was used as second choice in the use of terms in measurement of central tendency. Although being used by each of the twenty-one authors it did not occur as frequently as the mean. It was used by twenty-one authors with a total of four hundred thirty-eight times. The reason for its being used as a secondary term in measurements of central tendency may be accounted for by the fact that the median has not been rigorously defined, or, if defined has not been generally accepted and has led to considerable confusion in its computation.[2] It has been defined as that point on the scale of the frequency distribution on each side of which one half of the measures fall. Another definition is that the median of a series is that item, when arranged consecutively, divides the distribution into equal parts.[3] Because of these differences of opinion as to its definition, and the difficulty of its computation, the median has not been as popular as a measure of central tendency as it might be if a more definite and uniform de-

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[1] See table page 7

[2] C. A. Gregory, Fundamentals of Educational Measurement. p. 290.

[3] H. Secrist, An Introduction to Statistical Methods p. 238.

finition was formulated and computation simplified by the leading authorities in the field of mental measurement.

3. The Mode. The mode, defined as that measure of central tendency of a variable fact which appears more frequently than measures directly above or below it[1] or in more simple language, the score made by most of the pupils[2] was found by this research to be used fewer times than any of the other measures of central tendency. The mode was used by only ten of the twenty-one authors and appearing only sixty-nine times in the measurement texts. The mode has its advantage over the mean in that it shows precisely where the majority of the cases fall, rather than being misled by an average that has been greatly raised or lowered by an extreme case which may not be a true measurement.[3] Another advantage is in the simplicity of its determination as it is only necessary to examine the frequency distribution and locate the interval where the maximum frequency occurs. The reasons for this infrequency of occurrence as shown by these data are that the mode is unstable and may be markedly changed

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[1] C. A. Gregory, Fundamentals of Educational Measurement, p. 287.

[2] Wright and Smith, Tests and Measurements, p. 50.

[3] C. A. Gregory, Fundamentals of Educational Measurement, p. 287.

by the shifting of a few cases[1] and only deals with the most representative measures and neglects the extreme cases as it is determined by the most frequent measures only.[2] Probably the most common formula for its calculations that give approximations to the true mode is that three times the median less twice the mean equals the mode.[3] In summing up the preceding discoussion, the nature of the data and the problem to be solved must determine the measure of central tendency to be used in computation. If the size of the measures and the number of cases are to be taken intoconsideration, then the mean is the term to be used. If, however, the most characteristic measure of the group is wanted, the mode best satisfies this condition. The mean has the advantage of being a common measure and one with which the public is familiar and its computation simple, but is greatly effected by extreme cases in which instances the median or the mode would be more desirable.

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[1] Wright and Smith, Tests and Measurements, p. 50.

[2] C. A. Gregory, Fundamentals of Educational Measurement, p. 302.

[3] See table 1, page 7.

B. Measures of Variability

Some measures of variability, expressed as the distance on the scale that will include a certain proportion of the measures in the distribution, was found to have been used rather generally by each of the twenty-one authors, depending largely upon the nature of the distribution and the arbitrary choice of the writer. The four measures of variability from which the authorities might elect to use either or all of them are range, standard deviation, quartile deviation, and mean deviation. This investigation showed that these measures were used six hundred and twenty-four times and the rank as to times used was range, standard deviation, quartile deviation and mean deviation.[1]

1. Range. The range of a series of scores or measures is the distance from the highest to the lowest measure and indicates the extent to which the extreme measures differ or vary, It indicates somewhat the closeness of grouping of the measures and is always a measure of distance on the scale. The data showed that the range was the most common term used as a measure of variability, having been used three hundred and thirteen times by nineteen of the twenty-one authors.[2]

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[1] See table page 14

[2] See table page 14

This condition was to be expected as the range is the distance covered by all the measures, while the other terms may include some distinct part of all the measures. In order to compute the range it is necessary to know the largest measure and the smallest measure and then group the date into step intervals and subtract the lower limit of the lowest step interval from the upper limit of the highest step interval.[1] The range as a measure of variability is the most commonly used and the easiest computed but is the least reliable because it is so easily effected by the variation of a single score.

2. Standard Deviation. The standard deviation, which includes approximately the middle two-thirds of the distribution,[2] is the square root of the mean of the squares of the deviations, when taken from a measure of central tendency, either the mean or the median. This measure was found to have been used by sixteen of the twenty-one authors one hundred and ninety-four times.[3] In computing the standard deviation the formula $\sqrt{\frac{\Sigma d^2}{N}}$ is used when the series is simple, if, however, the number of cases is large, the data are arranged in a frequency distribution and the formula $SD = \sqrt{\frac{\Sigma fd^2}{N}}$ is used. A point in favor of the use

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[1] M. E. MacDonald, Statistics for Teachers, p. 112

[2] C. W. Odell, Educational Statistics, p. 201

[3] See table page 14

of the standard deviation is the fact that it bears a definite relation to the normal probability curve. It has the same relation to the curve that the radius of a circle bears to the circle.[1] When the standard deviations are small the measures are concentrated near the center of the curve and the curve rises rapidly and if the standard deviation is great the curve is flat and the measures are scattered widely from the center.

3. Quartile Deviation. The quartile or median deviation was found to rank third in measures of variability used, having been used by nine of the twenty-one authors but used rather sparingly, appearing only sixty-two times.[2] The quartile deviation applies to that portion of the distribution between the first and third quartiles and is computed by taking one half the range contained in the middle half of the distribution. The formula used most commonly is $Q.D = \frac{Q_3 - Q_1}{2}$ or the first quartile subtracted from the third quartile and the remainder divided by two. In the use of the quartile deviation it does not show a complete description of the total distributions but gives a

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[1] C. A. Gregory, Educational Measurements, p. 321

[2] See table page 14

TABLE II

FREQUENCY OF OCCURRENCE OF THE MEASURES OF VARIABILITY

Authors	Range	Standard Deviation	Quartile Deviation	Mean Deviation	Total
Greene and Jorgensen	10	1	5	0	16
Monroe, DeVoss, & Kelly	0	0	0	0	0
B. R. Buckingham	1	3	2	1	6
M.R.Trabue	34	8	0	12	54
T.L.Kelly	24	30	0	0	54
W.A.McCall	5	21	4	9	39
H.O.Rugg	20	5	1	0	26
H.O.Rugg	27	24	16	0	67
E.M.Paulu	1	0	0	0	1
S.L.Pressey	6	0	0	0	0
C.A.Gregory	15	25	1	15	46
Smith And Wright	14	4	0	0	18
L.M.Terman	13	0	0	7	20
Wilson and Hoke	9	1	0	0	10
F.N.Freeman	29	2	0	0	31
W.S.Monroe	19	17	3	11	49
Ruch and Stoddard	16	7	0	0	23
P.M.Symonds	15	10	0	0	25
W.S.Monroe	0	0	0	0	0
G.M.Ruch	19	23	2	0	44
H.A.Greene	36	14	28	0	78
Total	313	194	62	55	624

statement as to the form of the distribution with some measure of its central tendency and some measure of its dispersion and in the majority of the standard tests will tell the most important part of the story.

4. Mean Deviation. The mean deviation, the mean of all the deviations from a point of central tendency, when laid off on each side of the average in a normal distribution, includes, roughly, fifty-seven and five tenths per cent of the cases. The mean deviation was used by six of the twenty-one authors with a total of fifty-five times used, placing it in fourth place in the use of the measures of variability.[1] This may be accounted for by the fact that the mean and standard deviation are used for the same purpose with the standard deviation being the most accurate and most desirable method of ascertaining the deviation from points of central tendency. An advantage of its use is the fact that it may be computed without going through the laborious task of tabulating the scores. It may be computed from either the median or the mean and would be the same from either if the distributions were symmetrical. From a mathematical standpoint it would seem that the median

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[1] See table page 14

is the proper measure of central tendency to use in the computation of the mean deviation.[1] It may be found by adding together all the deviations from a point of central tendency and dividing the sum by the number of measures in the group.

C. Measures of Relationship

Measures of relationship go a step farther than the mere knowledge as to the distribution of the measures in a series of educational data and enables us to compare one series with another and shows us the movement of the group as a whole. The terms used by the twenty-one authors in discussing measures of relationship were grouped into those of correlation, coefficient of correlation, zero correlation, positive, and negative correlation with the entire group having been used six hundred and twenty-six times.

1. Correlation. Correlation was found to refer to that interrelationship existing between the separate characters by which they tend, in some degree, to move together.[2] When two quantities are so related that the fluctuation in

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[1] C. A. Gregory, Educational Measurements, p. 309

[2] A. L. Bowley, Elements of Statistics, p. 316

one is in sympathy with the fluctuation in the other the quantities are said to be correlated. This term was used three hundred twenty-eight times by twenty of the twenty-one authors investigated. The coefficient of correlation is the unit with which we generally measure the degree of likeness or correlation of one series with another. It is a numerical index which compares and summarizes the extent to which the corresponding measures in two series depart from their respective averages. Although the coefficient of correlation is a very definite numerical expression which shows the degree or amount of relationship, it is rather difficult to interpret its meaning in ordinary thought and language. One of the questions that presents itself is how large a coefficient must be to be called high or how small to be called low and that a comparatively high correlation may be relatively low when compared with correlations obtained from other data or with a perfect correlation.[1] The coefficient of correlation was found to have been used two hundred sixty-nine times by seventeen of the twenty-one authors.[2] This term was found

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[1] C. W. Odell, Educational Statistics, p. 172

[2] See table page 19

to have been used rather generally since it is needed when any degree of relationship is shown to exist. The basic formula used to compute the coefficient of correlation is the Pearson Product-Moment method of $r = \frac{\Sigma xy}{\sqrt{\Sigma x^2 \Sigma y^2}}$ It is found in terms of measures of central tendency and measures of variability. The method used is to compute the mean of each series, find the deviation of each measure from its mean, multiply it by the corresponding deviation from the mean in the other series, and find the sum of the sum of these products for the numerator of the formula. The denominator is the product of the standard deviations of the two series. In order to gain any knowledge concerning the relationship of measures, which is very necessary in determining the possible development or retardation, some mathematical solution must be arrived at. The product-moment method of calculation has been the one most generally accepted to fill that need. Either positive or negative correlation may range all the way from perfect correlation, which means that not only do the variables of the two series vary in in the same direction, but that they vary equally, down to none at all which is zero correlation. If, after thorough computation, no correlation is found to exist between two

TABLE III

FREQUENCY OF OCCURRENCE OF THE MEASURES OF RELATIONSHIP

Author	Correlation	Coef. of Correl.	Zero Correl.	Negative Correl.	Positive Correl.
Greene and Jorgensen	8	7	1	1	1
Monroe, DeVoss, Kelly	6	5	0	0	0
B. R. Buckingham	3	1	0	0	0
M. R. Trabue	4	31	0	0	0
T.L.Kelly	24	9	0	0	0
W.A.McCall	33	5	3	0	0
H.O.Rugg	14	15	4	1	1
H.O.Rugg	30	11	0	0	0
E.M.Paulu	1	0	0	1	1
S.L.Pressey	4	1	0	0	0
C.A.Gregory	16	30	0	0	0
Smith and Wright	27	5	0	1	3
L.M.Terman	7	0	0	0	0
Wilson and Hoke	1	2	0	0	0
F.N.Freeman	35	34	1	3	2
W.S.Monroe	16	29	0	0	0
Ruch and Stoddard	14	0	0	0	1
P.M.Symonds	29	36	1	1	0
W.S.Monroe	0	0	0	0	0
G.M.Ruch	27	25	2	0	0
H.A.Greene	31	32	0	0	0
Total	328	289	12	8	9

series, it is interpreted as zero correlation. This condition was found to have been referred to twelve times by six of the authors.[1] Positive correlation means that the two variables vary together, that is as one increases the other tends to increase, as shown by six of the authors for a total of nine times used.[2] Negative correlation means that the two variables vary together, but as one increases the other tends to decrease, as shown by six of the authors for a total of eight times.[3]

D. Tabular Representation

Calculations are made and results found for some definite purpose. The reader is desirous of obtaining all the information possible about the subject under discussion. The author, in order to successfully portray the idea in mind, is very anxious to find some method by which this may be done with utmost satisfaction. The use of tabular representations has been very extensively resorted to, to bring out facts that discoussion fails to clearly bring before the reader. Some form of tabular representations are necessary before the different relationships, which are so necessary

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[1] See table III, p. 19.

[2] See table III, p. 19.

[3] See table III, p. 19.

in measurement, may be successfully calculated. Tables were used rather extensively by twenty of the authors with a total of six hundred and twenty-one times used.[1] The fact that one of the authors did not use tables in any form may be explained by the fact that his text was totally of the discussion method with no problem method presented in which tabular representation might be needed. Authors of more recent publications were found to have made use of tabular representations more extensively than those of the earlier publications. Tabular representations have enabled writers to say more in less space than would be possible in the discussion method. Measurements being largely mathematical and tables being a great aid to the statistician, the high degree of positive correlation between the statistical methods and measurement and the use of tabular representations may be accounted for.

E. Graphic Representations

The use of graphs to represent frequency distributions is a very common and satisfactory system because of the fact that data may be more clearly and effectively presented.

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[1] See table page 24

Many persons who are confused with tables may readily interpret well constructed graphs. Those who are able to understand tables will be more able to readily understand graphic representations. The field of graphic representtations is rather clearly divided into frequency polygons, bar diagrams, histograms, sectional bar diagrams and sector diagrams. These different forms of graphs were found to have been used rather extensively by each of the twenty-one authors. They were used four hundred and twenty-seven times by the twenty-one authors[1] in the order of frequency previously named, with no author failing to use graphs in some form or other.

1. Frequency Polygon. The frequency polygon was the graphic representation most frequently used, having been used by each of the authors with a total of two hundred and ninety-eight times used. This graph being simple in construction and easily interpreted has made it one of the most desirable one of the group. This graph is made by constructing a perpendicular, whose height represents the number of cases, at the mid-point of each interval and then connecting the tops of these perpendiculars by straight

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[1] See table page 24

lines, forming the frequency polygon. This method of representation has been used very extensively in the normal frequency curve showing the normal frequency distribution.

2. The Histogram. The histogram or column diagram is composed of a series of rectangles each of which has as its base one class interval and as its height the number of cases in the interval. Frequently the lines dividing the rectangles are omitted and the lines of the whole histogram drawn. This graph has an advantage over the frequency polygon in that the area of the space above each interval represents the frequency in that interval. The individual case may also be shown by its use, by dividing each rectangle into as many squares as there are cases and labeling each so that it can be identified. In the investigation it was found to have been used fifty-one times by fourteen of the authors.[1]

3. The Bar Diagram. The bar diagram was found to have been used by thirteen of the twenty-one authors for a total of fifty-five times.[2]

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[1] See table IV, p. 24.

[2] See table, page 24.

TABLE IV

FREQUENCY OF OCCURRENCE OF GRAPHIC AND TABULAR REPRESENTATIONS

Authors	Tables	Bar Diagram	Histogram	Frequency Polygon	Section Bar Diagram
Greene And Jorgensen	32	0	0	6	0
Monroe, De-Voss, Kelly	35	3	2	5	5
B.R. Buckingham	29	0	0	4	0
M.R.Trabue	32	7	12	40	2
T.L.Kelly	31	0	0	4	0
W.A.McCall	33	1	1	22	2
H.O.Rugg	31	14	9	45	4
H.O.Rugg	34	6	6	32	8
E.M.Paulu	31	11	2	13	2
S.L.Pressey	7	0	0	2	0
C.A.Gregory	30	1	6	9	0
Smith and Wright	31	1	2	11	0
L.M.Terman	0	0	1	1	0
Wilson and Hoke	35	0	4	7	3
F.N.Freeman	40	1	1	20	0
W.S.MOnroe	26	0	0	20	0
Ruch and Stoddard	30	1	1	2	0
P.M.Symonds	40	0	3	15	0
W.S.Monroe	27	3	22	22	1
G.M.Ruch	32	4	1	17	2
H.A.Greene	35	11	0	1	0
Total	621	54	51	298	34

This is a diagram constructed with vertical or horizontal bars, with a bar for each case and the frequency represented by the length of the bar. This graph is very readily understood and used quite often in graphic representation.

4. The Sectional Bar Diagram. The sectional bar diagram was used by eight of the authors with a total of twenty-four times used.[1] This may be used in order to represent parallel cases with their possible correlation on the same diagram. This graph meets with favor as used on a comparative basis.

F. Formulae

The use of the proper formulae is a very necessary factor in making the different computations in the field of measurement and research. In this research fifteen of the twenty-one authors was found to have used some formulae for a total of two hundred and eight times,[2] including the formulae for mean, quartile deviation, coefficient of correlation, and the probable error of the mean, median, sigma, and coefficient of correlation.

1. The Mean. In finding the mean six of the authors

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[1] See table page 28

[2] See table page 28

used the formula $M = \frac{\Sigma m}{N}$ or the sum of the values of all of the measures divided by the number of the measures.[1] This is the most simple way of computing the mean although it, many times, involves much labor. Three of the authorities used the formula $M = \frac{\Sigma f(m)}{N}$ or the mean equals the sum of the products of each measure times the frequency of the measure.[2] This formula may be used when the frequencies are large and considerable time and labor saved. Another method similiar to the second type is to group the measures in a frequency distribution by fives, with all of the cases in each class considered as being at the mid-point of each class. This formula would be $M = \frac{\Sigma fX}{N}$ or the sum of the frequencies times the mid-point of the measures.

2. The Median. In calculating the median the formula $Md. = \frac{N}{2}$ is the most commonly used. This is the number of cases divided by two and placing the median at that point on the scale. Some authors used the formula $M = \frac{N+1}{2}$ which is not mathematically sound as the results obtained by using this formula are not always the same. This for-

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[1] C. W. Odell, Educational Statistics, p. 66.

[2] C. A. Gregory, Fundamentals of Educational Measurement

mula arose through a misconception of the exact meaning of the median, it being taken for a particular score or measure rather than a point on the scale.[1]

3. Quartile Deviation. The formula $Q = \frac{Q_3 - Q_1}{2}$ was the one used by four of the authorities in finding the quartile deviation.[2] The result of this formula shows the quartile deviation to be one half the distance between the first and third quartiles. Some writers do not use this because it is sometimes not considered as a measure of variability at all, since it is not an actual distance from an average. It is a measure of variability only when the distribution is symmetrical, however, it may be considered as such without serious error.[3]

4. Average or Mean Deviation. The most commonly used formula for finding the average deviation is $AD = \frac{\Sigma d}{N}$ or the average deviation equals the sum of the deviations divided by the number of cases. This is an advantage because of its simplicity and is most desirable when the number of cases is small. Another formula used is $AD = \frac{\Sigma fd}{N}$ or average deviation equals the sum of the products of the frequency times the measure divided by the number of cases.

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[1] C. W. Odell, Educational Statistics

[2] C. W. Odell, Educational Statistics, p. 86

[3] C. W. Odell, Educational Statistics, p. 121

TABLE V

FREQUENCY OF OCCURRENCE OF THE FORMULAE

Author	Mean	Quartile Deviation	Average Deviation	Standard Deviation	Coef. Correl.	Prob. Error
Greene and Jorgensen	0	1	0	4	1	0
Monroe, De-Voss, Kelly	0	0	0	0	1	3
B.R. Buckingham	0	0	0	0	1	0
M.R.Trabue	2	0	0	2	3	1
T.L.Kelly	5	0	0	11	4	18
W.A.McCall	5	1	0	12	6	5
H.O.Rugg	0	2	0	0	4	2
H.O.Rugg	4	1	0	8	11	5
E.M.Paulu	1	0	0	0	0	0
S.L.Pressey	0	0	0	0	0	0
C.A.Gregory	2	2	0	2	10	1
Smith and Wright	0	0	0	0	0	1
L.M.Terman	0	0	0	0	0	0
Wilson and Hoke	0	0	0	0	0	0
F.N.Freeman	0	0	0	0	0	0
W.S.Monroe	0	0	3	1	34	31
Ruch and Stoddard	0	0	0	0	3	4
P.M.Symonds	0	0	1	0	0	0
W.S.Monroe	0	0	0	0	0	0
G.M.Ruch	2	0	0	0	0	0
H.A.Greene	0	0	0	2	6	6
Total	21	7	4	43	56	77

This may be used with an average number of cases. Where a great number of cases are considered the formula $A.D.=\frac{\Sigma fd+c(f_1-f_2)}{N}$ or average deviation equals the sum of frequency times the frequency loss minus the frequency gain divided by the number of cases times the size of the step interval.[1] This may be used when the data is grouped in intervals.

5. Standard Deviation. Some formula for the computation of the standard deviation was used forty-three times by nine of the authors with the formula $S.D.=\sqrt{\frac{\Sigma fd^2}{N}}$ being used by seven of the nine with a frequency of thirty times used.[2] This is computed by taking the square root of the sum of the frequencies times the deviation squared divided by the number of cases. This is to be used when data are arranged in frequency distribution. The formula $S.D.=\sqrt{\frac{\Sigma d^2}{N}}$ was used by five of the authors with a frequency of nine times used.[3] This is computed by taking the square root of the sum of the deviations squared divided by the number of cases. This is more simple in its computation and may be used for the standard deviation of

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[1] M. E. Macdonald, Practical Statistics, p. 121

[2] See table V, p. 28.

[3] See table V, p. 28.

a simple series. The formula $SD. = \sqrt{\frac{\Sigma f d^2}{N} - CXS}$ was used by three of the authors investigated.[1] This formula is used when the width of the class interval is greater than one unit and the assumed rather than the true mean is used.[2] In this formula the standard deviation equals the square root of the sum of the frequencies times the deviations squared divided by the number of the cases minus the corrected error times the size of the step interval.

6. Coefficient of Correlation. In the computing of the coefficient of correlation some formula was used by thirteen of the twenty-one authors for a total of fifty-four times.[3] The formula used most frequently was the Pearson's Product-Moment method of $r = \frac{\Sigma XY}{\sqrt{\Sigma X^2 - \Sigma Y^2}}$ or the sum of the deviation of a measure in one series from the mean times the deviation of a measure in the other series from the mean divided by the square root of the sum of the square of the deviation in one series times the sum of the square of the deviation in the other series. This method was used by twelve of the thirteen authors.[4] The formula used

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[1] C. W. Odell, Educational Statistics

[2] See table V, page 28.

[3] See table V, page 28.

[4] See table V, page 28.

by five of the thirteen authors was Spearman's Foot-Rule method of $R=1-\frac{6\Sigma g}{N^2-1}$ or the coefficient of correlation equals one minus six times the sum of the gains divided by the number of cases squared minus one.[1] The formula $\rho=1-\frac{6\Sigma d^2}{N(N^2-1)}$ using the Rank-Difference method was used by two of the authors. This formula is that the coefficient of correlation one minus six times the sum of the difference squared divided by the number of cases times the quantity, number of cases squared minus one.

6. Probable Error. Formulae for the computation of the probable error was used by eight of the twenty-one authors with a total of seventy-nine times used.[2] The formula $P.E=.6745\frac{SD}{\sqrt{N}}$ or probable error equals .6745 times the standard deviation divided by the square root of the number of cases, was used twenty-one times by six of the authors.[3] The formula $.8454\frac{SD}{\sqrt{N}}$ or the probable error equals .8454 times the standard deviation divided by the square root of the number of cases, was used twenty-one times by four of the authors in computing the probable error of the median. The formula $.6745\frac{SD}{\sqrt{2N}}$

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1 See table V, page 28.

2 See table V, page 28.

3 See table V, page 28.

or probable error of the standard deviation equals .6745 times the standard deviation divided by the square root of twice the number of cases, was used by three of the authors in computing the probable error of sigma. The formula $P.E. = .6745 \frac{1-r^2}{\sqrt{N}}$ or probable error equals .6745 times one minus the coefficient of correlation squared divided by the square root of the number of cases, was used by eight authors in computing the probable error of the coefficient of correlation.

III. RESULTS OF CHECKING THESES AND SURVEYS

In determining the frequency of occurrence of the different statistical terms, formulae, graphic, and tabular representations actually used in research work, twenty-one theses from Columbia and Chicago Universities which had been written by students of these universities applying for the bachelors, masters, and doctors degrees, were thoroughly examined and each occurrence checked. In addition to this work, twenty magazine articles and eight surveys were examined and results checked. This was done in order to determine to what extent these terms were being used by the different students of research and in what proportion they were being used to each other and to the same terms used in the twenty-one texts previously examined.

A. Measures of Central Tendency

In checking the above researches for the measures of central tendency, they were found to have been used by eighteen of the twenty-one theses writers for a total of

TABLE VI

MEASURES OF CENTRAL TENDENCY USED IN THESES

Theses Writers	Mean	Median	Mode
F.J.Kelly	57	14	0
W.A.McCall	27	0	0
F.R.Frazen	15	3	0
K.B.Graves	12	1	0
L.H.Kennon	2	0	0
W.F.Steacy	16	0	0
D.S.Snedden	20	4	0
S.G.Brinkley	12	0	0
A.D. Hollingshead	19	7	0
J.L.Stenquist	14	3	0
L.M.Hunsicker	0	0	0
E.L.Morphet	21	0	0
C.C.Weidemann	9	2	2
V.A.Jones	7	2	0
C.L.Jacobs	15	3	0
H.M.Garn	1	0	0
R.N.Hogan	6	11	0
S.R.Wells	2	1	1
L.O.McAffee	0	0	0
R.H.Waters	50	0	4
G.E.Wylie	5	0	0
Total	310	49	7

three hundred and ninety-one times and by each of the survey writers for a total of two hundred and ninety-four times making a total of six hundred and eighty-five times used by practical writers.[1]

1. The Mean. The mean was the most popular of the measures of central tendency, having been used by eighteen of the twenty-one theses writers and each of the ten survey writers for a total of five hundred and fifteen times used.[2] These figures included the arithmetic mean and the average which gave this term a more general use than the others.

2. The Median. The median was used by twelve of the twenty-one theses writers for a total of seventy-one times used and by eight of the ten surveys writers for a total of ninety-two times, making a grand total of one hundred and eighty-three times used by all.[3]

3. Mode. The mode did not seem to have been used very extensively in these writings as it was used only seven times by three of the authors,[4] while it was not used at all in the surveys.

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1 See table page 36

2 See table page 36

3 See table page 36

4 See table page 36

TABLE IX

MEASURES OF CENTRAL TENDENCY USED

IN SURVEYS

Surveys, and Writers of Articles	Mean	Median	Mode
Journal of Educational research	26	1	0
School Review, twenty articles	22	14	0
Indiana Rural Survey	35	5	0
Indiana Higher Learning Survey	15	0	0
Gary Survey	7	23	0
St.Paul Survey	8	14	0
Boise Survey	16	12	0
Grand Rapids Survey	29	12	0
Indiana Public Education	16	0	0
Smith Higher Learning Survey	28	11	0
Total	202	92	0

B. Measures of Variability

The different measures of variability were found to have been used by fourteen of the twenty-one theses writers with a total of one hundred and two times used and by eight of the ten survey writers for fifty-five times used making a total of one hundred and fifty-seven times used.

The range seemed to be the most desirable of measures of reliability being used fifty-eight times by thirteen of the theses authors and forty-nine times by eight of the survey writers.

The standard deviation was the next in order having been used forty-eight times by nine of the authors.[1]

The quartile deviation came next with only one of the theses writers using it[2] while none of the surveys contained it.[3]

The mean deviation was entirely left out of the twenty-one theses and the ten surveys.[4]

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[1] See table page 36

[2] See table page 36

[3] See table page 36

[4] See table page 36

TABLE VII

MEASURES OF VARIABILITY
USED IN RESEARCH

Survey Writers	Range	Standard Deviation	Quartile Deviation	Mean Deviation
F.J.Kelly	8	9	0	0
W.A.McCall	2	0	0	0
F.R.Frazen	0	9	0	0
K.B.Graves	3	1	0	0
L.H.Kennon	0	0	0	0
W.F.Stacey	0	0	0	0
D.S.Snedden	2	11	0	0
S.G.Brinkley	2	0	0	0
A.D. Hollingshead	21	17	0	0
J.L.Stenquist	4	6	0	0
L.M.Hunsicker	4	0	0	0
E.L.Morphet	4	0	0	0
C.C.Weidemann	1	0	0	0
V.A.Jones	4	0	0	0
C.L.Jacobs	2	0	0	0
H.M.Garn	0	0	0	0
R.N.Hogen	0	0	0	0
S.R.Wells	1	0	0	0
L.O.McAffee	0	0	0	0
R.H.Waters	0	0	0	0
G.E.Wylie	0	0	0	0
Total	58	44	0	0

TABLE X

MEASURES OF VARIABILITY

USED IN RESEARCH (SURVEYS)

Surveys and Magazine Articles	Range	Standard Deviation	Quartile Deviation
Journal of Educational Research	3	1	0
School Review (Twenty Articles)	1	0	0
Indiana Rural School Survey	0	0	0
Indiana Higher Learning Survey	3	0	0
Gary Survey	6	3	0
St.Paul Survey	13	0	0
Boise Survey	1	0	0
Grand Rapids Survey	12	0	2
Indiana Public Education Survey	10	0	0
Smith Higher Learning Survey	0	0	0
Total	49	4	2

Note: The Standard Deviation did not appear in any of the surveys.

C. Measures of Relationship

The measures of relationship were found to have been used two hundred and eleven times by fourteen of the twenty-one theses writers[1] and ninety times by six of the surveys writers for a total of three hundred three times. Correlation was the measure most often used with a total of two hundred and thirty-three times by twenty of the thirty-one theses and survey writers combined.[2] The coefficient of correlation was second in use with fourteen authors using it forty-eight times.[3] Negative correlation was used twenty times by four of the writers of theses with the positive correlation being used by only one of the theses writers,[4] with that of zero correlation left out entirely.[5]

D. Graphic and Tabular Representations

Graphic and tabular representations seemed to be very popular in the minds of the thirty-one writers of theses and surveys. In this, tabular representations took the lead, having been used by all of the thirty-one writers with a total of eleven hundred and sixty-one

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1 See table page 41

2 See table page 14

3 See table page 41

4 and 5 See tables pages 41

TABLE VIII

MEASURES OF RELATIONSHIP USED IN THESES

Theses Writers	Correlation	Coef. of correlation	Zero Correlation	Positive correlation	Negative Correlation
F.J.Kelly	6	8	0	0	0
W.A.McCall	16	9	0	0	11
F.R.Frazen	20	2	0	0	2
K.B.Graves	5	0	0	0	0
L.H.Kennon	17	0	0	0	0
W.F.Steacy	20	0	0	0	0
D.S.Snedden	15	1	0	2	0
S.G.Brinkley	18	2	0	0	0
A.D. Hollingshead	3	0	0	0	0
J.L.Stenquist	19	1	0	0	0
L.M.Hunsicker	7	T 2	0	0	0
E.L.Mophet	0	0	0	0	0
C.C.Weidermann	1	4	0	0	0
V.A.Jones	17	0	0	0	1
C.L.Jacobs	0	0	0	0	0
H.M.Garn	0	0	0	0	0
R.N.Hogan	0	0	0	0	0
S.R.Wells	2	0	0	0	0
L.O.McAffee	0	0	0	0	0
R.H.Water	0	0	0	0	0
G.E.Wylie	0	0	0	0	0
Total	159	39	0	0	2

TABLE XI

MEASURES OF RELATIONSHIP

USED IN SURVEYS

Surveys and Magazine Articles	Correlation	Coef. of Correlation	Zero Correlation	Negative Correlation	Positive Correlation
Journal of Educational Research	14	1	0	0	0
School Review (Twenty articles)	10	2	0	0	0
Indiana Rural School Survey	0	5	0	0	0
Indiana Higher Learning Survey	0	0	0	0	0
Gary Survey	12	0	0	6	0
St. Paul Survey	15	0	0	0	0
Boise Survey	0	0	0	0	0
Grand Rapids Survey	0	0	0	0	0
Indiana Public School Survey	0	0	0	0	0
Smith Higher Learning Survey	0	0	0	0	0
Total	60	8	0	6	0

times used.[1] Next came the frequency polygon with one hundred and eighty-eight times used by thirteen of the thirty-one authors.[2] Next in order was the bar diagram with a frequency of one hundred and ten times for eleven authors.[3] Sectional Bar diagrams were not used by any of the writers of theses or surveys.

E. Formulae

The different formulae as found in previous studies did not seem to be needed to satisfy the desires of these thirty-one students of research. In the twenty-one theses the formula for the coefficient of correlation was used only thirty-eight times, while only three of the surveys contained the formula. The formula for computing the probable error was used only eleven times in the theses and none in the surveys. The formula for the Standard Deviation was used one time in the theses and one time in the surveys. All the other formulae for computing the mean, median, quartile deviations, and average deviation were omitted entirely.[4]

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[1] See table page 46

[2] See table page 46

[3] See table page 46

[4] See table page 46

TABLE XII

GRAPHIC AND TABULAR REPRESENTATIONS USED IN THESES

Theses Writers	Tables	Frequency Polygon	Histogram	Bar Diagram	Sectional Bar Diagram
F.J.Kelly	58	1	7	2	1
W.A.McCall	12	0	0	0	0
F.R.Frazen	13	0	0	0	0
K.B.Graves	19	0	0	0	0
L.H.Kennon	10	0	0	0	0
W.F.Steacy	65	0	0	0	0
D.S.Snedden	12	0	0	0	0
S.G.Brinkley	19	0	0	0	0
A.D.Holl'head	35	0	0	0	0
J.L.Stenquist	8	0	15	0	0
L.M.Hunsicker	8	0	0	0	0
E.L.Morphet	20	0	0	2	0
C.C.Weidemann	38	0	0	1	0
V.A.Jones	14	9	0	0	0
C.L.Jacobs	8	0	0	0	0
H.M.Carn	38	22	0	4	0
R.N.Hogan	10	10	1	3	0
S.R.Wells	26	9	0	0	0
L.O.McAffee	5	0	0	0	0
R.H.Waters	14	1	20	0	0
Total	429	52	43	12	1

TABLE XIII

GRAPHIC AND TABULAR REPRESENTATIONS USED IN SURVEYS

Surveys and Magazine Articles	Tables	Frequency Polygon	Histogram	Bar Diagram	Sectional bar Diagram
Journal of Educational Research	17	3	0	3	0
School Review (Twenty Articles)	12	0	0	0	0
Indiana Rural	55	4	0	0	0
Indiana Higher Learning Survey	48	0	0	0	0
Gary Survey	94	50	2	10	0
St. Paul Survey	138	6	2	1	0
Boise Survey	57	13	0	26	0
Grand Rapids Survey	112	39	8	47	0
Indiana Public Education Survey	36	8	0	11	0
Smith Higher Learning Survey	153	14	0	0	0
Total	722	131	12	98	0

TABLE XIV

FORMULAE USED IN RESEARCH

Theses Writers	Standard Deviation	Coefficient of Correlation	Probable Error
E.E.Kelly		2	
W.A.McCall		4	1
F.R.Frazen	1	1	2
K.B.Graves			
L.H.Kennon		1	
W.F.Steacy			2
D.S.Snedden			
S.G.Brinkley		10	1
A.D.Holl'head			
J.L.Stenquist		2	
L.M.Hunsicker		2	
E.L.Morphet			
C.C.Weideman		2	
V.A.Jones		13	2
C.L.Jacobs			3
H.M.Garn			
R.N.Hogan			
S.R.Wells			
L.O.McAffee			
R.H.Waters		1	
G.E.Wylie			
Total	1	38	11

III. CONCLUSION

To arrive at the conclusion that all the terms, formulae, graphs, and tables as taught in the mental measurement classes of our colleges were not actually being used by the student in research work, it was necessary to examine, with a glossary of three hundred terms used in mental measurement as a guide,[1] twenty-one texts of the leading authors in the field of mental measurement in order to ascertain to what extent these terms were actually being taught in mental measurement classes.[2] These texts revealed that out of the three hundred terms suggested as a basis, only seventy-eight of them were used by the text book writers. Many of this number were terms that may be used generally, rather than specifically, such as: score, having been used more frequently than any other term, with scale running a close second, and the terms, average, frequemcy, and data being used rather freely. Of the terms of more specific meaning, median headed the list with a frequency of four hundred thirty-eight times used. Next came the term, norm, with

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[1] C. W. Odell, A Glossary of Three Hundred Terms Used in Research.

[2] See table page 63

three hundred forty-five times used; the term correlation with three hundred twenty-eight; intelligence quotient with three hundred seventeen; range with three hundred thirteen; and mental age, coefficient of correlation, objective, variability, mean, deviation, chronological age, probable error, validity, percentiles, standard deviation, ranking, rating, etc., appeared in this order respectively as to frequency of occurrence. Such terms as average variability unit, chance list, coefficient of correspondence, coefficient of intelligence, composite score, crude data, curvilinear relations, cycle test, decile, derived measure, experimental coefficient, frequency curve, profile chart, social age, etc., seemed to have either been embodied in some of the other terms or discarded completely as unnecessary to intelligent study. Such terms as these are not sufficiently definite to satisfy an exacting public. The terms used by approximately fifty per cent of the text book authors[1] were placed in the group of major terms and the remaining ones placed in the minor group as to frequency of occurrence. This former list consisted of

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[1] See table page 63

thirty-eight terms while the later list consisted of the remaining forty terms. The number of different terms used by the individual authors ranged from sixteen as the minimum by W. S. Monroe to forty-nine as the maximum by P. M. Symond,[1] with the median at thirty-six and seven tenths. None of these authors approach, very closely, the total number of the seventy-eight terms used as a group.

The five graphs were used very generally, with the frequency polygon being the most favored one,[2] having been used two hundred and ninety-eight times by twenty of the twenty-one authors. The use of the graphs varied from H. O. Rugg,[3] who used some form of graph seventy-two times down to H. A. Greene,[4] who used only two graphs in his entire text.

Tables were used rather freely by each of the twenty-one theses writers with the exception of L. M. Terman, who did not use any table at all, while H. A. Greene used the tables most frequently with a total of thirty-five tables used.[5]

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1 See table page 63

2 See table page 28

3 See table page 24

4 See table page 24

5 See table page 24

Formulae were not used very generally, the coefficient of correlation having been used by thirteen of the authors as a maximum, with average deviation as the minimum, having been used by only two authors.[1]

Terms that had fallen into the major class in the text books also appeared most frequently in the theses, as the same central tendency was noticeable in each of the major classes, but many of the major items in the text were not considered as necessary in the theses. The minor terms seemed to become more and more unnecessary as the research students applied his knowledge practically. Of the thirty-eight terms that were used frequently in the text books examined only fifteen of them were used with any degree of consistency in the theses examined. Of these fifteen, the majority could be classed as terms with a general rather than a specific meaning.[2] The term, average was used by eighteen of the twenty-one authors and the term score was used by eighteen writers also, with the term data used sixteen times and range, correlation, coefficient of correlation, mean, median, and mental age appearing in this re-

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[1] See table page 63

[2] See table page 63

spective order.

Tables seemed to be a favorite and very desirable method of bringing the data before the reader as they were used consistently throughout the texts and then were carried over into the practical side by being used by each of the theses writers for a total of four hundred forty-three times.[1] Uniformity seemed to be the thing that was most desired here in the presentation of these data and the table form met this requirement. The graphs were not used as frequently as the tables, as they were only used one hundred fourteen times with the frequency polygon first with fifty-two and the sectional bar diagram last, which did not appear in any of the theses.[2] The different formulae did not seem to be needed by the theses writers as they were only used sixty-nine times with that for coefficient of correlation being used thirty-eight times by ten of the authors, which was the only one that was used with any degree of consistency. This may be accounted for by the fact that practically all the computations were made outside of the actual theses and were not necessary in the final form, also that the

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[1] See table page 24

[2] See table page 28

computations made by the average theses writer are sufficiently simple that it is not necessary to reduce them to formulae.

In addition to the other investigations, twenty research articles and eight surveys were examined to see to what extent these same terms, formulae, tables, and graphs were being used in that field. These articles examined were ones that would find their way out of the realm of the educational institutions into that of the individuals taking part in the practical side of the question and in studying these different terms used in these surveys would give one a fair insight into what the public as a whole would need if these articles were to be absorbed by them and any results come from the research work. After these articles and surveys were thoroughly examined the data were compiled into usable form and notations made.[1] Of these articles only eight of the terms were used frequently enough to warrant their being placed in the major classification. These terms were all used for a grand total of eleven hundred times with the emphasis being placed upon the ones with more general meaning as in the case of the term,

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[1] See table page 63

average, being used one hundred eighty-two times by ten of the writers with the term, score, used one hundred fifty-one times by eight of the writers and the term, data, having been used one hundred twenty-five times by ten of the writers and the terms median, correlation, range, scale, and objective used in this order as to frequency with a total of three hundred twenty-nine times.[1]

The tables were used very consistently by each of the ten writers with a total of seven hundred twenty-two times, again showing that tables are a very desirable means of the presentation of data.[2]

Graphs were used by eight of the ten research men with a total of two hundred and forty-one times, bringing the use of graphs somewhat more to the front than was done by the theses writers, this may possibly have been done because of the necessity of placing this material on a more comparative basis than that of the theses.[3]

The different formulae were practically ommitted in these surveys and magazine articles as they were used by only three of the ten writers with a total of only five

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1 See table page 63

2 See table page 45

3 See table page 45

formulae used. Again it was brought out that formulae are not needed in the presentation of research articles. Several outstanding conditions were noticeable in the relationship existing between terms, formulae, tabular and graphic representations used in the measurement texts and those actually used by the student in research work. The findings in this research work would lead one to think that these three hundred terms suggested as a guide[1] should be classified as to importance. This would result in placing these terms in a classification of major and minor terms as to frequency of use.[2] This plan would be substantiated by the data which showed that the terms tended to cluster themselves around central tendencies with the frequency of occurrence very great of those of major importance with a gradual scattering of those of minor importance, even to the extent that some of them did not appear in either the text books or the research materials.[3] The tendency for these terms to group themselves under a few major groups was even more noticeable in the research articles than in the measurement texts.[4] This condition as to frequency of occurrence of

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[1] See C. W. Odell, Glossary of Three Hundred Terms Used in Research.

[2] See table page 63

[3] See table page 63

[4] See table page 63

these mental measurement terms need not imply that the terms placed in the minor classification are not worth learning, but that the emphasis should be placed upon the ones in the major classification with the ones in the minor class being taken up indirectly. Major emphasis should be placed upon the technique of research and the presentation of results in a practical, understandable form to the public, and that these mental measurement terms should be taught only to the extent to which they may be of practical use to the student in his work in the educational field in which he is to take an active part in the future. In conclusion one would say that the tendency is to use a smaller number of these terms, formulae, graphic and tabular representations with emphasis upon simplicity of understanding and ease of calculation. This may be accounted for by the fact that the student of research should be more interested in the quality of the terms used rather than the quantity. This would be further desirable because of the fact that he is presenting these findings to a class of people that are not statistically minded, who place the major emphasis upon the content of the article rather than

upon the method of approach. It is of vital importance that the results of research be presented in the best possible manner. These results should be presented in simplified form, from which the terminology and procedures involved in the study have been practically eliminated so that the findings may be readily comprehended by those persons who may be untrained in such technical matters but must nevertheless be depended upon to use the results in ways that may be desirable in the improvement of education. In this light one could recommend that the research student not be drilled persistently upon these three hundred theoretical terms[1] as suggested by the author but that the thirty-eight terms placed in the major list[2] coupled with a few from the upper part of the minor list[3] bringing the total number of essential terms up to fifty terms would give the student sufficient background to do research work so far as the terminology of mental measurements is concerned.

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[1] C. W. Odell, Glossary of Three Hundred Terms Used in Research.

[2] See table page 63

[3] See table page 63

V. APPENDIX

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TABLE XV

GENERAL TERMS USED IN TEXTS, THESES, AND SURVEYS

Statistical Terms Used	Times used in texts	Number of authors using term	Times used in theses	Number of authors using term	Times used in surveys	Number of authors using term
Achievement Age	32	8	0	0	1	1
Achievement Quotient	70	9	0	0	9	2
Achievement Ratio	3	3	6	0	12	2
Age norm	82	13	0	0	3	1
Age score	16	8	0	0	0	0
Age vari.unit	0	0	0	0	0	0
Assumed mean	60	7	0	0	0	0
Array	7	4	0	0	11	3
Attentuation	6	4	0	0	8	4
Average	549	20	182	10	274	18
Average deviation	11	6	4	1	28	1
Battery of tests	32	7	0	0	3	1
Bi-modal	1	1	0	0	0	0
Central tendency	105	14	0	0	8	3
Chance list	0	0	0	0	0	0
Class intervals	148	10	2	1	3	2
Coefficient of brightness	2	1	0	0	0	0
Coefficient of correlation	269	17	19	4	29	8
(Correspondence) Coefficient of	0	0	10	1	0	0
Coefficient of intelligence	0	0	0	0	0	0
Composite score	0	0	0	0	0	0
Chronolog. age	177	16	9	2	70	8
Constant error	32	6	0	0	0	0
Correlation	328	20	67	6	166	14
Data	330	21	125	10	149	16
Deviation	197	14	13	1	9	2
Educational age	54	8	0	0	7	1
Educational quotient	44	6	0	0	4	1
Experimental coefficient	0	0	0	0	0	0
Frequency	240	18	0	0	0	0
Ffequency table	59	6	1	1	2	1
Arithmetic mean	85	8	0	0	3	3
Grade norm	69	12	0	0	0	0
Grade score	4	2	16	2	0	0
Grouping	123	16	18	2	0	0
Index of bright	10	3	0	0	0	0
Index of reliability	5	1	0	0	0	0
Individual differences	8	4	0	0	2	1
Intelligence quotient	317	19	0	0	76	8
Mental age	299	18	22	3	0	0
Median	438	21	92	8	40	11
Mean	215	12	20	2	36	8
Mid-point	41	5	0	0	0	0
Mode	69	10	0	0	7	3
Negative correlation	8	6	6	1	14	3
Norm	345	17	8	3	18	5
Normal curve	95	12	2	1	1	1
Normal distribution	66	10	4	1	0	0
Objective	293	18	37	5	14	6
Percentiles	184	16	0	0	0	0
Positive Correlation	9	6	0	0	2	1
Probable error	187	14	1	1	8	4
Quartile	78	14	21	3	17	2
Quartile deviation	62	9	2	1	0	0
Range	313	18	49	8	58	13
Rank difference	2	2	0	0	0	0
Regression	22	6	0	0	2	1
Scale	625	21	84	8	87	6
Score	648	21	151	8	213	18
Sigma	35	5	0	0	0	0
Skewness	22	6	0	0	0	0
Standard Deviation	194	16	4	2	44	5
Step interval	98	11	10	1	0	0
Subjective	17	7	0	0	0	0
Percentile rank	0	0	0	0	0	0
Percentile range	33	5	0	0	0	0
Validity	206	16	17	2	26	7
Variability	250	18	41	4	29	2
Variable error	25	3	0	0	0	0
Zero correlation	12	6	0	0	0	0
Homogeneous grouping	44	12	6	3	0	0
Grouping Hetrogeneously	5	4	0	0	0	0
Remedial measures	80	13	3	1	0	0
Motivation	24	10	0	0	0	0
Mean deviation	55	6	0	0	0	0
Ranking	118	16	2	1	11	4
Rating	143	14	11	3	64	3
Coefficient of relationship	138	10	10	2	29	7
Bar diagrams used	55	3	98	6	12	5
Histograms used	51	14	12	3	43	4
Frequency polygons used	269	21	131	7	52	6
Sectional bar diagrams used	24	8	0	0	0	0
Tables used	621	20	722	10	443	21
Formulae to find the mean	21	6	0	0	0	0
Formula for the quart.deviation	7	4	0	0	0	0
Formula for the ave. deviation	4	2	0	0	0	0
Formulae for stand.deviation	43	9	1	1	1	1
Formulae for coef.of correl.	54	13	4	2	38	9
Formulae for probable error	79	8	0	0	11	5