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A COMPARISON OF TEST SCORES AND RATINGS FOR ENGINEER ENLISTED MEN TESTED AT FORT BELVOIR, OCTOBER 21, 1940

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From the standpoint of finding out the value of certain tests as an aid in selection of Army personnel, it was thought to be of considerable interest to prepare a detailed study of the relation between ability as shown by ratings and scores on four pencil-and-paper tests of men in three Engineer Companies at Fort Belvoir. The previous report contained the scores of individuals tested and a statement of the average and variability of the distribution of scores in each company. Of the whole group of 152 men tested, ratings of officers were received on a total of 126 men -- 19 from the 5th Engineers, 44 from the 56th Engineers, and 63 from the 394th Engineers.

Since the 5th Engineers' ratings were made on a different scale, and with specific attention to performance in two occupations according to the actual duties of the men concerned, their results have been treated in a different way from those of the other two organizations.

A tabulation of the 19 men from the 5th Engineer Company, subdivided into mechanics and clerks, is presented herewith (Table II). This table gives opposite the name of each man his rating and score on the test relevant to his occupation. From such a small number of cases, it is impossible to draw any general conclusion regarding the value of the tests in predicting ability. It will be noted that both lists contain individuals whose test scores disagree strikingly with their ratings. This does not necessarily mean that the tests are of no value in predicting a man's performance. Characteristics of an individual other than his ability play an important part in rating him. Tests of this type do not give any information about such factors.

The fact that certain of the tests under consideration in the present study do show selective power for the men from the other companies illustrates the advantage to be gained from their use where a sizeable number of men is available for selection.

A correlation coefficient is a measure of the degree of relation between two sets of measures -- in this case between a set of test-scores and ratings. Correlation coefficients were computed between test-scores and ratings for each test, separately for the 56th and 394th Engineers Companies. For the 56th Engineers, a Shop Company, these coefficients range from .32 for the Alpha test to .40 for the two mechanical ability tests. The order is reversed for the 394th Engineers, a Depot Company, Alpha ranking highest with .48 and Mechanical Movements lowest with .13.

A coefficient of correlation between test score and some measure of success tells how valid is the prediction of success when only the test-score is known. The coefficient itself is a mathematical expression for the degree to which the two sets of measures tend to vary together.

If a high score in one measure (such as a test) always goes with a high score in another measure (such as a rating) and low scores in the first measure go with low scores in the second, the correlation is high and positive. The extreme of this condition occurs when this correspondence in rank is perfect and accordingly the score in one set may be invariably predicted from knowledge of the other. This means a correlation of + 1.00. The opposite extreme is the case in which high scores in one set correspond with low scores in the other set. In this case the correlation coefficient is - 1.00. If the correspondence between the two sets is nil, the correlation coefficient equals zero. Values (such as the ones shown) between zero and + 1.00 indicate a certain degree of positive relationship. They are not to be interpreted directly as percentages of relationship. In general, high scores will tend to go with high ratings, and the variation in rating for any given score may be predicted from knowledge of the correlation coefficient for any given score. Geometrically, such a coefficient is the slope of the line of best fit to the mean ratings for each interval on the test-score scale. Knowing the equation of this line and the variability about this line makes possible an estimate of the distribution of ratings at any given score. If we have the score of a man on a certain test, we may, knowing nothing else about him, state what the probabilities are that he will make a certain rating.

In the case of the 44 men from the 56th Engineers, for example, the actual distribution of individuals according to mechanical movements score and ratings (shown in the table) gives a picture of how it is possible to predict ability from test score. The O'Rourke Mechanical Aptitude Test gives as useful predictions of ratings of shop men as does the Mechanical Movements Test. The discussion will be centered on Mechanical Movements results, however, since it requires only one-third the time of the other test. Also, the Mechanical Movements correlates significantly only with shop work, and the O'Rourke with both shop and clerical work. For discrimination at the lower range of mechanical ability the O'Rourke test is preferable, since there are a number of zero scores on the Mechanical Movements Test.

The correlation between Mechanical Movements test scores and ratings was .40, indicating a fairly strong positive relationship between the two measures, a condition borne out by Table 2. Poor men tend to be concentrated at the lower end of the test-score scale, good men at the upper end. From this distribution Table 3 was constructed giving the proportion of men falling in a certain range of ability (rating "fair" or better) for each score on the test. All the men scoring in the highest 5-point interval (20-24) have the competence represented by a rating of 3 (fair) or better. If we consider only the lowest class in the test-score scale, we can see that only 24 out of 100 men having a score of 0-4 have the competence represented by a rating of 3 or better. The higher we go on the scale of the test to make our selections, the greater the proportion of average and better-than-average men will be obtained.

A similar analysis of the distribution of Alpha scores for the 394th Engineers (Table 10) would indicate that 100 out of 100 men scoring 90 or above receive a rating of "fair" or better. The Alpha test, as shown by the size of its correlation for the 394th Engineers (Table 1), is the best test for predicting ratings of these men.

Results on the Clerical Checking Test (as evidenced by Table 1) are somewhat inconclusive. The War Department has published a new Clerical Aptitude Test, which is more comprehensive than the Clerical Checking test. It is suggested that the new Clerical Aptitude Test be tried out with groups of men such as the Companies under consideration. Supplies of this test (A.G.O., Form 18-1p) with directions for giving and scoring, and also of the Mechanical Movements Test (A.G.O., Form 18-2ap) may be obtained from Corps Area Headquarters.

Pending further studies based on larger numbers of cases, the following suggestions are offered:

(1) As an aid in selecting men for shop work, the Mechanical Movements Test would be useful. If a score of 15 or greater is taken as the minimum for such selection, a large proportion of the men chosen will have average or better-than-average ability for this type of work.

(2) For selecting men for depot and supply duties, the Alpha or a similar test, offers the best possibilities. The minimum Alpha score to assure a large proportion of men having average or better-than-average ability would be 90. This is approximately equivalent to a mean standard score (100) on the General Classification Test.