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A STATISTICAL STUDY OF FOUR MECHANICAL ABILITY TESTS

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PURPOSE

This study was undertaken to determine the extent to which a series of mechanical ability tests were related, and to observe any sex differences in the test results.

PROCEDURE

Fifty students at Grinnell College, 25 men and 25 women, were selected at random from the freshmen, sophomore, junior and senior classes to take the following tests: The Revised Minnesota Paper Form Board Test, Series AA; an experimental form of a test designed to measure mechanical aptitude; the Minnesota Spatial Relations Test; and the O'Connor Wiggly Block.

The Minnesota Paper Form Board is a multiple choice paper and pencil test requiring the subject to visualize and assemble mentally a set of blocks. The subject is asked to complete as many of the 64 items as he can within a 20 minute time limit. The highest possible score is 64, the total number of items.

The Mechanical Aptitude Test consists of the following five sections: technical information, tool naming, size discrimination, visualization, and dotting. The test requires 15 minutes, but each of the five sections is timed separately. It is possible to secure a score of 80, the total number of items on the test.

The Minnesota Spatial Relations Test requires the individual to fit many irregularly shaped blocks into a form board. The test is scored according to the total time, in seconds, taken to complete the task.

The O'Connor Wiggly Block consists of nine irregularly shaped pieces of wood, which, when fitted together, form a solid block 5½" x 5½" x 10". In this experiment the total number of blocks fitted together in three trials, of two minutes each, constituted the score on this test. This means that the highest possible score for the Wiggly Block performance is 27.

The range of scores, arithmetic mean, and standard deviation were obtained, and all the tests were inter-correlated by the Pearson product-moment method of simple correlation.

RESULTS

The range of scores, the arithmetic mean, and the standard deviation for the 25 men and 25 women are recorded in Table 1. These data reveal that while there is a large range of scores, the women's scores on the Mechanical Aptitude Test and Paper Form Board Test cluster surprisingly close to the mean. For example, the standard deviation for women on the Mechanical Aptitude Test is 1.24, while that of the men on the same test is 6.12. In the case of the Paper Form Board, the standard deviation for women is 1.46, while that for the men is 8.13.

The men very clearly excel the women in the Spatial Relations Test and the Mechanical Aptitude Test. In the case of the Spatial Relations Test the men, on the average, performed the task 26 seconds faster than the women. On the Mechanical Aptitude Test, sections of which measure mechanical achievement, the men on the average excel the women by 13 score points. No other major sex differences are apparent from the data.

The twelve correlation coefficients computed are recorded in Table 2. The highest correlation coefficient is .52 and the lowest is –.01. This suggests that in no instance is the correlation sufficiently high to justify the prediction of one test score from another. This indicates that each test is measuring a somewhat different ability. In many instances, however, one can see that a positive relationship exists. This is true particularly in the Wiggly Block and the Spatial Relations Test (for men, $r = .52$ and for women $r = .34$); the Spatial Relations Test and the Mechanical Aptitude Test (for men $r = .43$ and for women $r = .41$); the Wiggly Block and Mechanical Aptitude Test (for men $r = .48$); the Wiggly Block and Paper Form Board Test (for men $r = .51$); and the Spatial Relations Test and Paper Form Board Test (for men $r = .52$). To some degree, therefore, these tests are measuring similar abilities.

TABLE 1
THE RANGE, MEAN, AND STANDARD DEVIATION OF THE 25 MEN AND THE 25 WOMEN WHO TOOK THE FOUR TESTS OF MECHANICAL ABILITY.

Name of Test		*Range of Scores*	*Mean*	*Standard Deviation*
*Wiggly Block	Men	7-27	18.84	6.07
	Women	5-27	16.28	6.64
**Minn. Spatial	Men	162-401	299.00	56.36
Relations Test	Women	225-442	325.08	48.06
*Mechanical	Men	48-73	66.41	6.12
Aptitude	Women	43-71	53.86	1.24
*Minn. Paper	Men	26-59	47.00	8.13
Form Board	Women	31-58	48.56	1.46

*Score in terms of items passed
**Score in seconds

TABLE 2
INTER-CORRELATIONS FOR THE FOUR TESTS OF MECHANICAL ABILITY

	Minn. Spatial Relations Test		*Mechanical Aptitude*		*Minn. Paper Form Board*	
	Men	Women	Men	Women	Men	Women
Wiggly Block	.52	.34	.48	–.01	.51	.23
Minn. Spatial Relations Test			.43	.41	.52	.16
Mechanical Aptitude					.14	.06

It is interesting to note from some of the correlation coefficients that there are large differences between the men and women. In the case of the Wiggly Block and the Mechanical Aptitude Test, for men $r = .48$, and for women it is practically zero. Almost the same situation holds in the case of the Spatial Relations Test and the Paper Form Board Test, where for men $r = .52$, and for women $r = .16$. There is also a major difference in the case of the Wiggly Block and Paper Form Board Test where for men $r = .51$ and for women $r = .23$. While the reasons for these differences cannot be stated with certainty, the small variations of scores as indicated by the standard deviation, would tend to lower the correlation coefficient. Recall that on the Mechanical Aptitude Test, the S. D. for women was 1.24 and on the Paper Form Board Test, the S. D. was 1.46; while on the Mechanical Aptitude Test the S.D. for men was 6.12 and on the Paper Form Board Test the S. D. for men was 8.13.

CONCLUSIONS

1. Men excelled primarily on the Minnesota Spatial Relations Test and the Mechanical Aptitude Test. No large sex differences existed on the other tests.

2. The scores for women on the Mechanical Aptitude Test and the Paper Form Board Test varied so slightly from the mean that significant correlation coefficients with other tests were unlikely.

3. No coefficient of correlation was sufficiently high to predict any one score from any of the other scores; yet, several were high enough to suggest that the tests were measuring similar abilities.

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