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“Verbal Factor” and “Number Factor”— A Study of Two Tests

By JOHN E. WILLIAMS AND C. D'A. GERKEN

INTRODUCTION

The psychologist working as a counselor in a student personnel office has come to depend upon psychometric data to sharpen the reliability and validity of his judgments. Although he is cautious about trusting test labels, and well aware of the unwritten *caveat* accompanying each test manual, every once in a while the counselor may be brought up short by the summation effect of discrepancies he notices in day-to-day work with test data. The present study had its origin in just this fashion. It grew out of attempts of counselors to extract the maximum amount of meaningful information from test data.

Counselors and their clients need to be as certain as possible that adequate estimations of abilities be obtained. To this end it is sound practice to base judgments upon multiple rather than single measurements of the abilities being evaluated. In attempting to evaluate general or scholastic abilities of college student clients, counselors in the Student Counseling Office of the State University of Iowa have used both the 1941 edition of the AMERICAN COUNCIL ON EDUCATION PSYCHOLOGICAL EXAMINATION FOR COLLEGE FRESHMEN (3*) and the Form A of the WESMAN PERSONNEL CLASSIFICATION TEST (4). These are referred to herein as the A C E and the P C T, respectively. Each instrument yields sub-scores for two factors, verbal and numerical.

The Thurstones (3, pages 2, 3) state that the purpose of the A C E examination “is to appraise what has been called scholastic aptitude or general intelligence with special reference to the requirements of most college curricula.” It is also claimed that “there seems to be justification for using the two principal sub-scores as well as the total score” for counseling purposes. In the manual for the P C T, Wesman (4, page 3) states the test “measures the two most generally useful aspects of mental ability—verbal reasoning and numerical ability”. This test also yields sub-scores for each ability in addition to a total score. The author writes that “the separate score technique is of major importance in . . . counseling individuals.”

*Numbers in parentheses refer to items in the bibliography.

The writers are grateful to Miss Florence Fout, Psychometrist in the Student Counseling Office, for accurate statistical work.

The problem considered in this study first arose when it was noticed that many students who earned relatively higher scores on the verbal factor sub-test on one instrument earned relatively higher scores on the number factor sub-test on the other. In as much as the two examinations were supposedly measuring comparable functions, it was thought some investigation of the observed discrepancies would be worth while. That this might be of practical value to counselors as well as of theoretical value to psychometricians is obvious.

PROCEDURES

The subjects in this study were 146 male college students who came voluntarily to a student counseling office for educational and vocational counseling. They represented all classes in the University from beginning freshmen to advanced graduate students, and included all levels of achievement as measured by grades earned in course work. Test data for this investigation were obtained by searching through the counseling office files and selecting for study all male students who had been administered the two tests under investigation and who were not subsequently referred to clinical psychologists for counseling concerning problems of a non-educational or non-vocational nature. There is every reason to believe they comprise a cross section of college men who seek counseling with reference to educational and vocational plans and who have no obvious personal adjustment problems.

Although the two instruments being investigated were not routinely administered as part of a battery to every student, there is no reason to suppose there was any biasing selection factor. The two tests were administered whenever in the opinion of the counselor it was desirable to evaluate carefully any student's abilities to succeed in college work. They were also given whenever it was felt desirable to determine whether or not a student was more adept in working with numerical or quantitative tasks than with verbal or linguistic tasks.

It should be emphasized that test data used in the study were obtained under superior testing conditions. Clients coming of their own volition to a college student personnel office are typically highly motivated. Too, since the tests were administered either singly or in groups of two or three, the psychometrist made certain that each subject understood exactly what he was expected to do and that he adhered rigorously to testing procedures. It must be assumed under these circumstances that certain sources of error associated with mass testing were minimized.

RESULTS

All possible product-moment correlations of scores of the two tests were computed. These are reported in Table 1.

Table 1

Intercorrelations, Means, and Standard Deviations for the Sub-tests and Total Tests of the 1941 *American Council on Education Psychological Examination for College Freshmen* and the *Wesman Personnel Classification Test, Form A*.

(Data are based on scores earned by 146 college men.)

| | ACE-Q | ACE-L | ACE-T | PCT-N | PCT-V | PCT-T |
|--------------------------|--------|--------|--------|---------|---------|---------|
| Mean | 46.21 | 71.10 | 117.2 | 12.96 | 24.91 | 37.86 |
| Sigma | 10.0 | 15.0 | 21.7 | 3.6 | 6.1 | 8.5 |
| ACE-Q (number factor) | (.87*) | .49 | .80 | .54 | .48 | .58 |
| ACE-L (verbal factor) | | (.95*) | .91 | .45 | .70 | .68 |
| ACE-T (total score) | | | (.95*) | .48 | .70 | .74 |
| PCT-N (number factor) | | | | (.83**) | .51 | .78 |
| PCT-V (verbal factor) | | | | | (.76**) | .94 |
| PCT-T (total score) | | | | | | (.82**) |

*Corrected odd-even reliability coefficients for a previous comparable form of the ACE. Based on scores for college Freshmen. Reported in (1).

**Corrected split-half reliability coefficients for the PCT. Based on scores for 436 college sophomores. Reported in (4).

It is well beyond the scope of this paper to attempt to consider all the implications arising from the obtained correlations. The background of the problem, stated in common sense terms, is this: here are two tests of the same general type, each of which yields two sub-test scores for supposedly comparable variables, and for each of which it is recommended by the authors that the separate sub-test scores are meaningful for counseling purposes. The question with which we are concerned is: what evidence is there for believing the two tests sample the same areas of ability? Stated more precisely: what is the extent of the relationships between "general ability", "verbal ability" and "numerical ability" as defined by the tests?

The obtained correlation between the total scores was .74. If this is evaluated by the understandably rigorous standards to which intelligence test constructors adhere, it appears to be only a "fair"

correlation. Only slightly more than half of the variance of one test is predictable from the other.

When the two "verbal factor" sub-scores were correlated, the resulting coefficient was .70. Only one half of the variance of one sub-test is predictable from the other sub-test purportedly measuring a comparable function. The correlation between the two "number factor" sub-tests was .54. In this case less than one third of the variance of one is predictable from the other. The cross correlations indicated the A C E numerical sub-test and the P C T verbal sub-test were related to the extent of .48, while the A C E verbal sub-test and the P C T numerical sub-test correlated .45.

The two sub-tests of the P C T correlated .51 for the sample of 146 men students. In his manual Wesman (4) reports correlations of a comparable sort ranging from .25 for a group of 93 college freshmen to .57 for a group of 194 mechanical apprentice applicants. None of the described groups was similar enough to the one used in the present study to make comparisons meaningful. The correlation between the sub-tests for the A C E was .49 for the present group. The Thurstones (2) report an intercorrelation of .55 between the sub-tests for several thousand college freshmen who took a former comparable edition of the A C E. These correlations indicate that the two abilities as defined by the sub-tests should certainly not be considered as possessing any high degree of independence.

DISCUSSION

The present study is concerned only with scores earned by male college students who sought educational and vocational counseling services. A great deal of research has shown that meaningful predictions of college grades can be made from scores students earn on the A C E examination. No reported research correlating academic achievement with scores on the P C T has been found in the literature. For this latter reason, as well as for those reasons evident in the present study, counselors seem justified at present in being cautious about using the P C T in college personnel work or in considering it a convenient substitute for the A C E. This is not to say that the P C T might not be useful to the counselor; it merely points out that the test's usefulness must first be demonstrated before reliance is placed upon its results as a predictor of college achievement.

In conclusion, it seems reasonable to believe the two tests considered here are far from being equivalent or useful for comparable purposes in a student personnel office. Practically, then, it may

well be claimed that verbal and numerical abilities as defined and tested by one instrument are not highly related to comparable abilities as defined and tested by the other. The study emphasizes again the dangers of placing undue reliance upon test labels. The counselor using tests should base his predictions ideally upon demonstrated relationships or, in the absence of such information, at least upon a realistic and sophisticated attempt to understand the variables his tests measure.

SUMMARY

Counselors using two general ability tests of the "verbal factor" and "number factor" type became skeptical about the variables being measured when it was noticed there was often disagreement between results clients achieved on the sub-tests. Data from student personnel files were obtained for 146 men and comparisons made of scores earned by these students. Results indicated initial skepticism was justified. Correlations obtained between "number factor" and "verbal factor" sub-tests of the two instruments were only .54 and .70, respectively. These values are far less than would be desirable if it is to be presumed that factors having comparable labels measure in fact the same functions.

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