

PREDICTING TAS (UC3/UW3) EXAMINATION SUCCESS BY MEANS OF PSYCHOLOGICAL TESTS—A FOLLOW-UP STUDY (II)

by

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ABSTRACT

In a preliminary follow-up study of the classification project standard scores made by 118 sailors of UC3/UW3 specialist course of TAS Branch on five psychological tests of mental ability viz., PGIT, VGIT, MCT, MAT and MASYT were correlated between themselves and also with the percentage of marks scored $\left(\frac{\text{Obtained score}}{\text{Maximum marks}} \times 100 \right)$ in the TAS (UC3/UW3) examination which acted as the criterion in this study. PGIT, VGIT and MCT were found to be the best predictor. Regression coefficients of test scores on the criterion were calculated by the Aitken's method. It was found by analysis of variance that the addition of two tests to PGIT did raise the multiple correlation significantly but other three tests did not raise it significantly. It was concluded that for better prediction of TAS (UC3/UW3) examination success not only should the composition of the test battery be suitably modified by bringing in purer tests of differential primary mental abilities but due account must also be taken of personality factors—industriousness, interest etc.,—together with previous service records and assessments by the divisional officer and the school attainments.

Introduction

During the years 1956—58, the Naval Psychological Research Unit (NPRU) Cochin had organised pilot classification project for 204 sailors of the Torpedo and Anti-Submarine School drawn from seven pre-admission Third Specialist (UC3/UW3) courses, courses V to XI. This classification programme for first five courses was built upon group tests of intelligence, mechanical aptitude and aural acuity. But the programme in the last two courses, namely the 10th and 11th, was made comprehensive by taking into account the relevant background information obtained from the school and the sailors' service records and the sailors themselves. Each sailor was interviewed by the Psychologist. The recommendations regarding classification were made to the concerned Training Officer with whom rested the final authority to implement them according to his best judgement.

This paper is concerned with the preliminary follow-up study of the TAS (UC3/UW3) examination results of 118 sailors, for whom scores were available on all the psychological tests and the criterion. The results reported

in this paper, being based on a small sample and that too by no means entirely homogeneous, cannot be taken as final. The more widely applicable and stable findings, it is hoped, would emerge in due course when the results of other similar follow-up studies are pooled together.

Aims

This preliminary follow-up study was taken up with three main aims in view:—

- (i) to determine the correlations between different psychological tests,
- (ii) to determine the correlations between different psychological tests and the criterion, and
- (iii) to determine the regression coefficients of psychological tests on the criterion and to assess their predictive validities separately as well as compositely.

Psychological Tests

The classification procedure as mentioned earlier was built, among other things, on psychological tests of intelligence and mechanical aptitude. These included two tests of intelligence namely, VGIT (Verbal Group Test of Intelligence) and PGIT (Performance Group Test of Intelligence) adapted by N.P.R.U. The three mechanical aptitude tests included were MCT (a Paper-pencil Mechanical Comprehension Test), MAT (a paper-pencil Mechanical Adaptability Test) and MASYT (a Mechanical Assembly Test). (1)

Correlations

The product-moment correlations between five psychological tests were calculated from standard scores made on these tests which were readily available from the profiles. (2) Raw scores had earlier been converted into standard scores on the basis of means and standard deviations for this particular group of 204 sailors. For purposes of calculating the correlations, however, only 118 cases were taken into account for whom scores were available on all the five tests and the criterion. The product moment correlations, which have been duly checked are set out in Table I.

TABLE I
Inter-Correlations of Standard Scores on five Psychological Tests
(N 118)

Test	No	1	2	3	4	5
PGIT	1	—				
VGIT	2	.63	—			
MCT	3	.22	.25	—		
MAT	4	.21	.27	.87	—	
MASYT	5	.32	.13	.29	.04	—

(1) Sharma, A., Naval Psychological Research Unit, Cochin. Classification Procedure Series I—Manual for TAS Classification Battery.

(2) Sharma, A., Naval Psychological Research Unit, Cochin. Classification Procedure Series II—A Classification Project: The Allocation of TAS Branch Ratings to Two types of Categories: pp 12—17.

The inter-test correlations, it will be observed, are all positive (with one exception r_{54}) and are not very large except r_{12} and r_{34} . The high correlation of .87 between tests 3 and 4 suggests that these tests are more or less homogeneous in nature. The general trend of low inter-test correlations appears to be conducive to satisfactory validity though it may not help in raising the reliability of the battery of tests.

Criterion Correlations

The criterion in this follow-up study was taken to be the percentage of marks made by a student in the Third Specialist Course (UC3/UW3) examination. The maximum score in this examination is 800. There are five subjects in each course—UC3 and UW3—and all are compulsory. The minimum percentage of marks to pass the examination is 50 per cent. This is by no means a reliable and valid criterion, but under the circumstances, it was the only criterion available for this preliminary follow-up study.

The product moment correlations between the criterion *i.e.*, the percentage of marks scored and the standard scores on the five psychological tests are set out in Table 2.

TABLE 2

Correlations between the Criterion and Psychological Tests

(N 118)

Criterion \ Tests	PGIT	VGIT	MCT	MAT	MASYT
r	.32	.25	.26	.02	.16

Although all these correlations are positive and significant at .01 level (except one), the relationship is only slight. In an ideal battery of tests one would expect low inter-test correlations and high criterion-test correlations. The inter-test correlations were on the whole satisfactory but so is not the case with criterion test correlations.

Regression Coefficients

The regression coefficients of psychological test scores on the criterion score were calculated by Aitken's modified method with each pivot converted to unity, as set by Thomson. (3) These are given in Table 3.

(3) Thomson, G.H., *The Factorial Analysis of Human Ability*, London. University of London Press, Fifth Edition, 1951, pp 205—209

TABLE 3

Regression Coefficients of Tests on the Criterion

PGIT	VGIT	MCT	MAT	MASYT
.320				
.270	.080			
.250	.045	.193		
.230	.106	.949	-.881	
.399	.067	1.588	-1.482	-.496

If only PGIT is used, its regression co-efficient is .320. If PGIT and VGIT, are used, their regression co-efficients are .270 and .080. If PGIT, VGIT, and MCT are used, their regression coefficients are .250, .045 and .193. If PGIT, VGIT, MCT and MAT are used, the regression coefficients are .230, .106, .949 and -.881. And if all the five tests viz., PGIT, VGIT, MCT, MAT and MASYT are used, the regression coefficients are .399, .067, 1.588, -1.482 and -.496.

Predictive Validity

It will be seen from Table 2 that the single best predictor of TAS (UC3/UW3) examination success is PGIT with $r = .32$. Next in order comes MCT with $r = .26$; then comes VGIT with $r = .25$; after that comes MASYT with $r = .16$ and last of all comes MAT with $r = .02$. It is not at all surprising that PGIT which is a performance group test of Intelligence, should turn out to be the single best predictor of TAS (UC3/UW3) examination success for the simple reason that it is loaded with 'gf' ability which is also the ability required to a large extent for success in the TAS (UC3/UW3) examination which is predominantly practical in character and involves skilled operation of intricate machines. The same reason accounts for the fact that non-verbal and pictorial tests of mechanical aptitude and mental ability, comparatively speaking, are better predictors of TAS (UC3/UW3) examination success.

Having considered the predictive validity of psychological tests singly, we may now examine their validities when combined together. These result are set out in Table 4.

TABLE 4

Multiple Correlations by Combining Different Psychological Tests

SN	Battery of Tests	Calculation	Max	Max
1	PGIT	$\cdot 32 \times \cdot 32$	$\cdot 1024$	$\cdot 320$
2	PGIT & VGIT	$\cdot 32 \times \cdot 270 \cdot 25 \times \cdot 080$	$\cdot 1064$	$\cdot 33$
3	PGIT, VGIT & MCT	$\cdot 32 \times \cdot 250 \cdot 25 \times \cdot 045 \cdot 26 \times \cdot 193$	$\cdot 1414$	$\cdot 38$
4	PGIT, VGIT, MCT & MAT	$\cdot 32 \times \cdot 230 \cdot 25 \times \cdot 106 \cdot 26 \times \cdot 949$ $— \cdot 02 \times \cdot 8811$	$\cdot 3292$	$\cdot 57$
5	PGIT, VGIT, MCT, MAT & MASYT	$\cdot 32 \times \cdot 399 \cdot 25 \times \cdot 067 \cdot 26 \times 1 \cdot 588$ $— \cdot 02 \times 1 \cdot 482 \quad — \cdot 16 \times 496$	$\cdot 4483$	$\cdot 67$

The addition of VGIT to PGIT does not raise the multiple correlation practically ($F=51$). The addition of MCT to PGIT and VGIT also does not make a significant addition to the multiple correlation revealed by analysis of variance. ($F=4.3$). The addition of MAT to PGIT, VGIT and MCT raises the multiple correlations by $\cdot 19$ and raise it also significantly ($F=29.8$). Similarly it was found that the addition of MASYT to PGIT, VGIT, MCT and MAT raised the multiple correlation significantly ($F=24.1$). (4)

From this it would be seen that, as could be expected, MAT and MASYT raise the multiple correlation significantly, both of these tests are positively correlated with MCT. The correlation of MCT with MAT is very high (Table 1). Further the correlations of MAT and MASYT with the criterion are low (Table 2) and their regression coefficients on the criterion score negative.

Conclusions

(i) So far as predicting the TAS (UC3/UW3) examination success is concerned, PGIT, MCT and VGIT are as good a predictor as the entire battery of five tests viz., PGIT, VGIT, MCT, MAT and MASYT.

(ii) Neither these three tests alone nor the battery of five tests can be said to be an efficient predictor of the TAS (UC3/UW3) examination success. The predictive validity of $\cdot 32$ of PGIT and the percentage of variance accounted for (45 per cent) by the battery as a whole suggests that the TAS (UC3/UW3) examination success is much too complex a phenomenon to be explained or predicted exclusively, or even largely by means of one or more psychological

tests of mental abilities. In the words of Vernon:⁵ 'Educational attainments especially when measured by school or other examinations are naturally more complex and we have already seen that a somewhat ill defined factor of industriousness plus interest which Alexander calls X, plays a prominent part. Similar factors, variously called interest, study or 'halo' have been reported in American investigations by Holsinger and Swineford (1939), Sisk (1940), Carroll (1943) and Comery (1949).' Therefore, for better prediction of TAS (UC3/UW3) examination success not only should the composition of the test battery be suitably modified by bringing in purer tests of differential primary mental abilities but due account must also be taken of personality factors together with previous service records.

(iii) If the only purpose of using this battery of five tests were to predict TAS (UC3/UW3) examination success, the principle of parsimony would indicate that this purpose could as well be accomplished by means of PGIT, VGIT and MCT, but if these five tests were used, along with other assessments and relevant background information from the sub-divisional officer and the school, for the larger purposes of classification, they may still have their place and utility in a practical programme of allocation and classification such as ours by giving some idea of the sailors relative strength and weaknesses in different mental abilities. It would, therefore, be improper to drop the tests from the programme of classification because they were not good predictors of TAS examination success.

⁵ Vernon, P.E., *The Structure of Human Abilities*, London, Methuen, (1950) pp. 37-48.