A CLASSIFICATION PROJECT FOR THIRD SPECIALIST COURSE SAILORS—A FOLLOW-UP STUDY (I)

by

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ABSTRACT

This paper is concerned with the follow-up study of Third Specialist Qualifying Course Examination of 118 sailors of one Naval School, which is a highly technical one.

The standard scores made by sailors on VGIT, PGIT, MCT, MAT and MASYT were analysed, separately, in terms of their TSQC Examination results, and critical scores or chances of success established. These were found to be roughly zero standard score in all cases. The predictive validities of these tests at their respective critical scores were found to be ·48 for VGIT, 1·00 for PGIT, ·20 for MCT, ·58 for MAT and 1·00 for MASYT, each test considered separately. The predictive validity for the entire classification procedure taken as a whole was found to be ·93 which is very highly satisfactory indeed. The need of individual diagnostic testing and counselling in case of Fit-Fails and Unfit-Fails, has been stressed.

The findings reported in this paper, it is emphasised, are at present only *tentative* as they relate to one school and that, too, of a highly selected nature. The more representative and stable findings, it is hoped, would emerge in due course when the data from similar other follow-up studies are pooled together.

Introduction

During the years 1956-58, the Naval Psychological Research Unit (NPRU), Cochin had organised pilot Classification Project for 204 sailors of the Torpedo & Anti-Submarine School drawn from seven pre-admission Third Specialist (UC_3/UW_3) Courses, courses V to XI. This classification programme for first five courses was built on 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' previous service records and the sailors themselves. Each sailor was also 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 Third Specialist Qualifying Course (TSQC) Examination results of 118 sailors of the courses five to nine and 58 sailors of the tenth and eleventh courses. This small group of 118 sailors, however, is by no means entirely homogeneous, while it has no doubt a majority of good ratings, there are also some backward and dull ones. The results reported in this paper, therefore, cannot be taken as final. The more widely applicable and stable findings we hope, would emerge in due course when the results of other similar follow-up studies are pooled together. Further the particular naval school under report. The Torpedo and Antisubmarine School—is a highly technical one and the results obtained here cannot be generalised for all the naval schools.

Aims

The follow-up study was taken up with three main aims in view—

(*i*) To analyse the standard scores on different psychological tests, separately, in relation to TSQC examination results, and to determine roughly the critical scores for even chances of success in the TSQC examination.

(*ii*) To determine the predictive validity of different psychological tests at the level of critical scores, separately, and also of the total classification procedure considered as a whole.

(*iii*) To diagnose the cases of Fit-Fail and Unfit-Fail with a view to organise counselling services for them.

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 Intelligence Test of the Applied Psychological Research Wing) and PGIT (Performance Group Intelligence Test adapted by NPRU). 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)

Analysis of Test Scores

The scores made by the sailors on different tests of intelligence and aptitude, may now be analysed in relation to their TSQC Examination results. It may be added for general information that a candidate must earn 50 per cent of the aggregate marks to pass the Examination in C Category, 60 per cent to obtain B category and 80 per cent to be placed in A Category.

(1) Naval Psychological Reserch Unit, Cochin: Classification Procedure Series I by A. Sharma.

Analysis of VGIT

The analysis of VGIT results is given in Table 1. Raw Scores made by sailors on this test were first converted into Standard Scores (mean=23·58, SD=-13·61, N=146). As was expected, this verbal group test of intelligence was found to discriminate fairly and the distribution of raw scores on it was almost normal.

TABLE—1

Standard Scores on AP_3 in relation to TSQC Examination Results

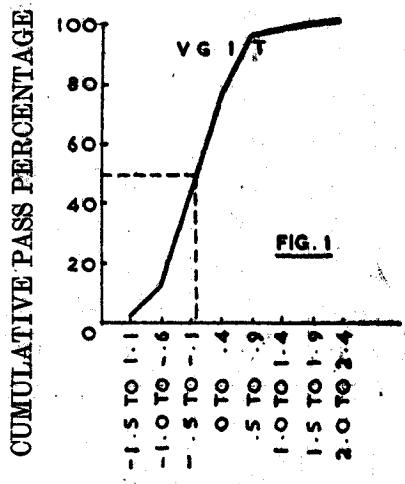
Standard Scores.	Category			Total Pass	Fail	Total of Pass & Fail	Cumulative Pass F	Cumulative pass % (Col. 8/114)
	A	B	C					
1	2	3	4	5	6	7	8	9
2·0 to 2·4	..	..	1	1	..	1	114	100
1·5 to 1·9	2	..	..	2	..	2	113	99
1·0 to 1·4	..	2	1	3	..	3	111	97
·5 to ·9	..	16	4	20	..	20	108	95
0 to ·4	1	28	7	36	1	37	88	77
—·5 to —·1	1	22	15	38	3	41	52	46
—1·0 to —·6	..	8	5	13	..	13	14	12
—1·5to—1·1	..	..	1	1	..	1	1	1
Total	4	76	34	114	4	118	..	..
Mean Standard score	·82	·08	—·06	—06	—·18	..	..	..
S.D.	·70	·49	·65	·65	·43	..	..	..

An examination of Table 1 would reveal two outstanding facts about it.

(*i*) Firstly, there is a wide dispersion of standard scores amongst the A, B and C groups. A sailor with as high a standard score as 2·0 to 2·4 on AP_3 has obtained category C (i.e. has just qualified), whereas another with as low a standard scrore as —·5 to —·1 has managed to pass it in category A. This makes the task of establishing reliable critical scores for individual classification and allocation extremely difficult.

(*ii*) Secondly, in spite of very wide dispersion of standard scores amongst the A, B and C categories, the three groups differ significantly in their mean scores. Similarly, the Pass and Fail groups differ significantly between themselves. This suggests that critical scores may be established roughly for group classification purposes.

In order to establish critical scores with even chances, *i.e.*, 50-50 chances of passing the TSQC examination, the pass percentages were worked out. These pass percentages, unfortunately though not unexpectedly, indicate a very erratic trend. With a very small sample, and that too of a highly selected though by no means homogeneous nature, and with a rather different out-look than that of a University examination; one could not possibly expect anything better than this. Ideally speaking, with a large and representative sample one would expect a regular and steady decline in pass percentages as one would descend from the highest to the lowest score. This being ruled out in case of our sample it was decided as a measure of expediency, to calculate the cumulative pass percentages as given in column 9 of Table 1. These have been plotted



in Figure 1, Appendix I, from where it will be seen that for 50-50 chances of passing the TSQC examination on the basis of this test, the critical standard score would be exactly Zero. The predictive validity of this test at zero critical score dotted line in Table 1, would be discussed in the next section.

Analysis of PGIT

The analysis of PGIT is given in Table 2. Raw Scores made on this test were converted into standard scores on the basis of mean = 46·32 and S.D.=20·10, the two statistics as they turned out on the results of 143 cases.

TABLE—2

Standard Scores on PGIT in relation to TSQC Examination Results

Standard Scores	Category			Total pass	Fail	Total of pass & fail	Cumulative pass F	Cumulative pass % (Col. 8/114)
	A	B	C					
1	2	3	4	5	6	7	8	9
3·0 to 3·4	2	..	..	2	..	2	114	100
2·5 to 2·9	..	1	1	2	..	2	112	98
2·0 to 2·4	..	3	1	5	..	5	110	96
1·5 to 1·9	1	5	1	7	..	7	105	92
1·0 to 1·4	1	6	1	7	..	7	98	86
·5 to ·9	..	9	5	14	..	14	91	80
0 to ·4	..	7	7	14	..	14	77	68
—·5 to —·1	..	21	9	30	2	32	63	55
—1·0 to —·6	..	19	5	24	2	26	33	29
—1·5 to—1·1	..	5	3	8	..	8	9	8
—2·0 to—1·6	..	..	1	1	..	1	1	1
Total	4	76	34	114	4	118	..	..
Mean standard score	2·32	·06	·07	·14	—·55	..	..	..
S.D.	·90	·90	·95	1·45	·90	..	..	..

The observations and comments made on Table 1 apply to Table 2 with even greater force. Some of the sailors, it seems obvious, did not react to this test properly.

Figure 2 would indicate that the critical score for even chances of success on PGIT would be about —·2 which, for rough and ready purposes, may be treated as zero.

Analysis of MCT

The analysis of MCT is given in Table 3. Raw scores made on this test were converted into standard scores on the basis of mean = 14·25 and S.D.=6·25, (N=146).

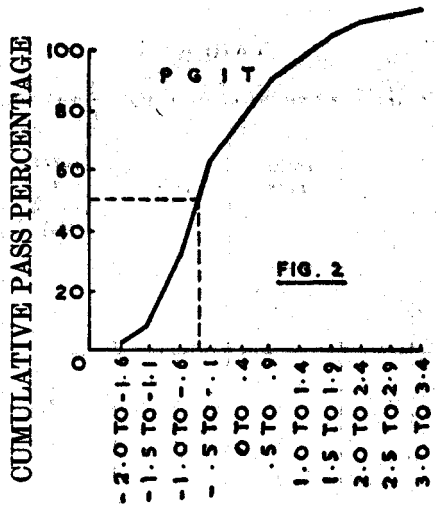
TABLE—3

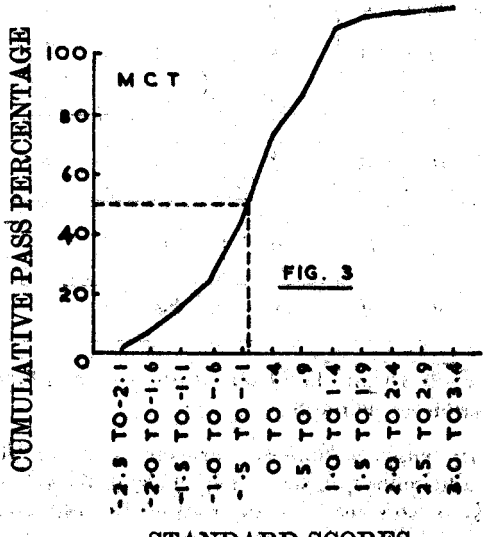
Standard Scores on MCT in relation to TSQC Examination Results.

Standard scores	Category			Total pass	Fail	Total of pass & fail	Cumulative pass F	Cumulative pass percentage (col. 8/114)
	A	B	C					
1	2	3	4	5	6	7	8	9
3·0 to 3·4	..	1	..	1	..	1	114	100
2·5 to 2·9	..	..	..	0	..	0	113	99
2·0 to 2·4	1	..	..	1	..	1	113	99
1·5 to 1·9	2	3	..	5	..	5	112	98
1·0 to 1·4	..	15	6	21	..	21	107	94
·5 to ·9	1	7	5	13	1	14	86	75
0 to ·4	..	23	6	29	1	30	73	64
—·5 to —·1	..	13	6	19	..	19	44	39
—1·0 to —·6	..	5	5	10	1	11	25	22
—1·5 to —1·1	..	6	2	8	..	8	15	10
—2·0 to —1·6	..	2	4	6	1	7	8	6
—2·5 to —2·1	..	1	..	1	..	1	1	1
Total	4	76	34	114	4	118	..	..
Mean Standard score	1·19	·19	—·12	·15	—·42	..	..	..
S.D.	·55	·95	·95	·97	·95	..	..	..

Here again, we find that the observations and comments made on Table 1 are equally applicable to Table 3.

Figure 3, would suggest that the critical score on this test is about ·1 which, for rough and ready purposes, may be treated as equivalent to zero. The predictive validity of this test at zero standard score would be discussed in the next section.


CUMULATIVE PASS PERCENTAGE
100
80
60
40
20
0
P G I T
FIG. 2
-2.0 TO -1.6
-1.5 TO -1.1
-1.0 TO -.6
-.5 TO -.1
0 TO .4
.5 TO .9
1.0 TO 1.4
1.5 TO 1.9
2.0 TO 2.4
2.5 TO 2.9
3.0 TO 3.4
STANDARD SCORES


CUMULATIVE PASS PERCENTAGE
100
80
60
40
20
0
M C T
FIG. 3
-2.5 TO-2.1
-2.0 TO-1.6
-1.5 TO-1.1
-1.0 TO-.6
-.5 TO-.1
0 TO .4
.5 TO .9
1.0 TO 1.4
1.5 TO 1.9
2.0 TO 2.4
2.5 TO 2.9
3.0 TO 3.4
STANDARD SCORES

Analysis of MAT

The analysis of MAT is set out in Table 4. Raw scores made in this test were converted into standard scores on the basis of Mean=69·14 and SD=14·20 (N=14·6).

TABLE—4

Standard Scores on MAT in relation to TSQC Examination Results.

Standard score	Categories			Total pass	Fail	Total of Pass & Fail	Cumulative pass F	Cumulative pass percentage (col. 8/114)
	A	B	C					
1	2	3	4	5	6	7	8	9
1·5 to 1·9	1	..	3	4	..	4	114	100
1·0 to 1·4	1	6	1	8	..	8	110	96
·5 to ·9	1	25	7	33	..	33	100	90
0 to ·4	1	19	11	31	2	33	69	61
–·5 to –·1	..	15	5	20	1	21	38	33
–1·0 to –·6	..	5	5	10	1	11	18	16
–1·5 to –1·1	..	1	1	2	..	2	8	7
–2·0 to –1·6	..	1	1	2	..	2	6	5
–2·5 to –2·1	..	2	..	2	..	2	4	4
–3·0 to –2·6	..	..	..	..	..	..	2	2
–3·5 to 3·1	..	2	..	2	..	2	2	2
Total	4	76	34	114	4	118	..	..
Mean standard score	·95	·11	·70	·13	–·18	..	..	..
S.D.	·55	·94	·82	·88	·45	..	..	..

The observations regarding dispersions of standard scores, as made on Table 1, hold good here also. The critical score at even chances of success in this case is about ·2 (see Fig. 4) which for rough and ready purposes, may be treated as equivalent to zero. The predictive validity of this test at zero standard score would be discussed in the next section.

Analysis of MASYT

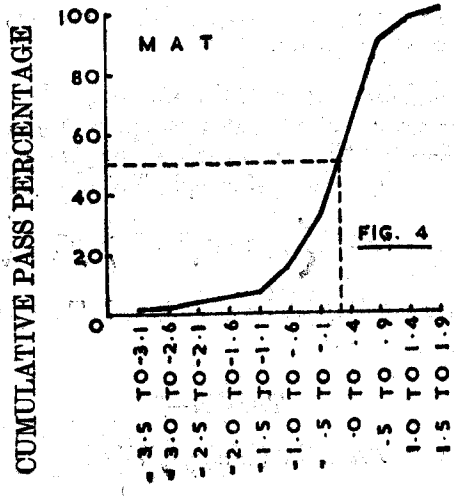
The analysis of MASYT is presented in Table 5. Raw scores made on this test were translated into standard scores on the basis of mean = 136·38 and S.D.=23·76 as actually found for 143 cases out of the total sample of 204.

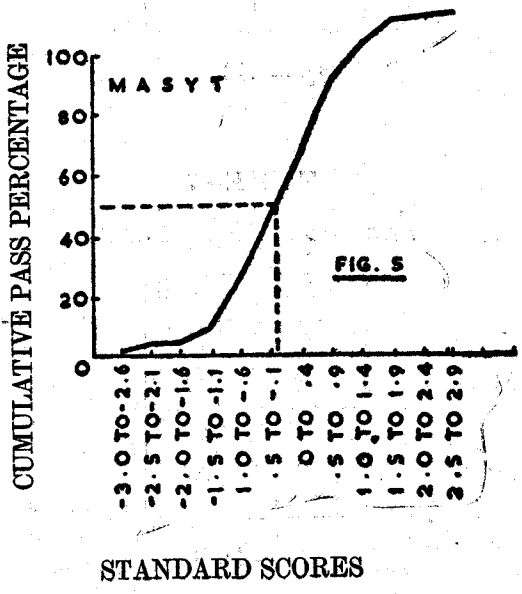
TABLE—5

Standard scores on MASYT in relation to TSQC Examination Results.

Standard score	Categories			Total pass	Fail	Total of Pass & Fail	Cumulative pass frequency F	Cumulative pass% (col. 8/114)
	A	B	C					
1	2	3	4	5	6	7	8	9
2·5 to 2·9	1	..	..	1	..	1	114	100
2·0 to 2·4	1	..	..	1	..	1	113	99
1·5 to 1·9	1	6	..	7	..	7	112	98
1·0 to 1·4	..	9	3	12	..	12	105	92
·5 to ·9	..	13	11	24	..	24	93	82
0 to ·4	1	15	6	22	..	22	69	60
–·5 to –·1	..	11	9	20	2	22	47	41
–1·0 to –·6	..	15	3	18	1	19	27	24
–1·5 to –1·1	..	4	1	5	1	6	9	8
–2·0 to –1·6	..	1	..	1	..	1	4	4
–2·2 to –2·1	..	..	1	1	..	1	3	3
–3·0 to –2·6	..	2	..	2	..	2	2	2
Total	4	76	34	114	4	118	..	..
Mean Standard score	1·7	·08	·11	·57	–·68	..	..	..
S.D.	·90	1·04	·75	·85	·83	..	..	..

The observations and comments made on Table 1 hold good here also, the critical score in this case is found to be ·1 (see Fig. 5) which, for rough and ready purposes may be treated as equivalent to zero. The predictive validity of this test at zero critical standard score would be discussed in the next section.


MAT
FIG. 4
CUMULATIVE PASS PERCENTAGE
100
80
60
40
20
0
-3.5 TO-3.1
-3.0 TO-2.6
-2.5 TO-2.1
-2.0 TO-1.6
-1.5 TO-1.1
-1.0 TO -.6
-.5 TO -.1
0 TO .4
.5 TO .9
1.0 TO 1.4
1.5 TO 1.9
STANDARD SCORES


MASYT
FIG. 5
CUMULATIVE PASS PERCENTAGE
100
80
60
40
20
0
-3.0 TO-2.6
-2.5 TO-2.1
-2.0 TO-1.6
-1.5 TO-1.1
1.0 TO -.6
.5 TO -.1
0 TO .4
.5 TO .9
1.0 TO 1.4
1.5 TO 1.9
2.0 TO 2.4
2.5 TO 2.9
STANDARD SCORES

Predictive Validity of Tests

The problem of validity is intimately linked with the reliability of the criterion. The Final Examination result which constitutes our criterion in this follow-up study, is by no means a very reliable criterion, but it is the only criterion available for our purposes.

The predictive validity of each of the five tests taken separately, at their respective critical scores, as established in the preceding section may be determined from Tables 6—10. The tetrachoric r's may be estimated well enough for practical purposes by the cosine—pi formula (2)

$$r_t = \left(\cos 180^\circ \sqrt{bc} \Big/ \left\{ \sqrt{ad} + \sqrt{bc} \right\} \right)$$

where a, b, c and d are the frequencies as defined in Tables 6—10.

TABLE—6

Predictive Validity of VGIT

	Pass	Fail
Above 0SS	62 (*a*)	1 (*b*)
Below 0SS	52 (*c*)	3 (*d*)

$r_t = .48$

TABLE—7

Predictive Validity of PGIT

	Pass	Fail
Above 0SS	51 (*a*)	0 (*b*)
Below 0SS	63 (*c*)	4 (*d*)

$r_t = 1.00$

(2) Guilford, J. P., Fundamental Statistics in Psychology and Education, New York: McGraw-Hill, 1950, p. 336.

TABLE—8

Predictive Validity of MCT

	Pass	Fail
Above OSS	40 (*a*)	2 (*b*)
Below OSS	44 (*c*)	2 (*d*)

$r_t = \cdot 20$

TABLE—9

Predictive Validity of MAT

	Pass	Fail
Above OSS	76 (*a*)	2 (*b*)
Below OSS	38 (*c*)	2 (*d*)

$r_t = \cdot 58$

TABLE—10

Predictive Validity of MASYT

	Pass	Fail
Above OSS	67 (*a*)	0 (*b*)
Below OSS	47 (*c*)	4 (*d*)

$r_t = 1 \cdot 00$

The predictive validities of the five psychological tests, taken separately have been summarised in Table 11.

TABLE—11

Predictive Validities of Psychological Tests

S. No.	Test	Predictive Validity
1	VGIT	·48
2	PGIT	1·00
3	MCT	·20
4	MAT	·58
5	MASYT	1·00

A number of important conclusions follow from Table 11.

(1) PGIT and MASYT, considered separately yield the highest predictive validity. This is not at all surprising, for these tests being performance in nature are able to sample the abilities required for passing the TSQC Examination, which, too, is largely practical in character and involves skilled operation of intricate instruments.

(2) All the verbal tests, except MAT which has been specially prepared by the APW, (Applied Psychological Research Wing) turn out to be poor predictors of success at the Final Examination, obviously for want of practical and mechanical factors.

(3) The low predictive validities need not cause undue concern regarding the validity of psychological tests. It only emphasises pointedly, that the TSQC Examination success is not, and obviously cannot be, a function of intelligence or mental abilities alone. It is a complex phenomenon in which a large number of other factors play a complicated role. To attain better predictive validity, the psychologist must, therefore, carefully assess all the factors in the total situation rather than rely on psychological tests above.

Our guidance procedure since the 10th course as indicated earlier had, therefore, been built on psychological tests of intelligence, aptitude and personality, combined with relevant background information, obtained from the School and the individual. In appraising fitness of a sailor to pass the TSQC Examination, all the relevant facts about his mental abilities, personality, qualities, such as perseverance, regularity, diligence, interests and aptitudes, his scholastic attainments and his previous service background, were studied carefully, and an integrated report drawn upon the basis of the total situation under consideration. The fitness or otherwise of a sailor thus determined holistically though rather subjectively, it was hoped, would yield a fairly satisfactory predictive validity. Table 12 shows that this expectation has been reasonably fulfilled by actual results (10th and 11th courses).

TABLE—12

Predictive Validity of the Classification Procedure as a whole

	Pass	Fail
Fit	40 (*a*)	1 (*b*)
Unfit	7 (*c*)	10 (*d*)

$r_t = .93$

The predictive validity of ·93 obtained on the basis of the classification procedure as a whole is highly satisfactory, treated separately or compositely it emphasises boldly the need of appraising fitness for third specialist course on the basis of the classification programme as a whole rather than on the basis of psychological tests alone.

Counselling

A close analysis of Table 12 reveals some most important results of this follow-up study.

1. It would be seen from Table 12 that 1 sailor who was judged fit by us, failed the TSQC Examination. The problem of Fit-Fails is of special importance to the counsellor. The causes of their failure deserve careful diagnosis. The classification file of this particular sailor was looked into again by us at the NPRU. The main cause of his failure seemed to be poor emotional adjustment coupled with dislike for manual and skilled work. These Fit-Fails deserve special consideration at the hands of counsellors, for all of them are potentially quite capable of working out better personality adjustments for themselves, only if they are given necessary advice and counselling at the proper time.

2. The Unfit-Fails also need careful diagnosis and sympathetic counselling. on the part of psychologists, for most of them also can be saved from unnecessary frustration and failure and helped to succeed and adjust themselves better

3. From the point of view of research, there is yet another class of sailors who deserve careful diagnosis. These are the unfit-passes. In this follow up study, as many as 7 sailors who were considered unfit by us passed the TSQC Examination successfully. Out of these 2 passed in B category and the rest in C. A review of their classification files revealed that most of them just managed to get through, while those who obtained B category, did so mainly because of their very high scores in operational side.

4. It would be noted that this follow-up study has high-lighted the problem of Fit-Fails and Unfit-Fails. It is being planned to take up these cases for individual diagnostic testing. This is what one may like to call the human side of this follow-up study which is as fascinating to the counsellor as the statistical side of it is to the psychometrician.

Conclusions

We may now summarise the main findings of this follow-up study in terms of the aims set out in the beginning of this paper—

(*i*) The critical scores for even chances of success in the TSQC Examination on VGIT, PGIT, MCT, MAT and MASYT, each treated separately, were found to be roughly zero standard score.

(*ii*) The predictive validity of VGIT, PGIT, MCT, MAT and MASYT at the critical scores mentioned above were estimated roughly by tetrachoric 'r' and were found to be ·48, 1·00, ·20, ·58 and 1·00 respectively. The total classification Procedure built comprehensively on mental abilities, personality qualities, interests and aptitudes, scholastic attainments and social background was found to be a better predictor of success in TSQC Examination. Its predictive validity was found to be ·93 which is highly satisfactory indeed.

(*iii*) The cases of Fit-Fails and Unfit-Fails were high lighted. These are now being taken up for individual diagnostic testing and counselling during the current session.

These findings, it needs be emphasised, are at present only tentative as they relate only to one institution and that, too, of a highly technical nature. The more representative and stable findings, it is hoped, would emerge as more follow up data accumulate in due course.

Acknowledgements

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