

# Modern Objective Tests and Selections in Industry And Training Courses

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SELECTION of technical persons for large industries is getting increasingly complex due to rapid industrialisation and consequent expansion in the manpower involved in India. For maximising the output of basic industries like Steel, Copper, Aluminium, Coal, the industries producing equipments from Telephones to Aircraft and those associated with transport and heavy machinery, it needs cautious steps in the process of expansion and selection of suitable persons to fill in the key points. Young graduate engineers bear the important responsibility of designing equipments to suit special needs for this country, of increasing production and of providing proper maintenance and care. These persons must be thorough in the techniques of designing, production and maintenance as well as be good supervisors to handle the delicate human relations with and among the persons under their charge. They also maintain the communication link between top management and various levels of workers. Success in such jobs depends upon their ability, technical knowledge and also upon their personality pattern involving leadership, co-operativeness, initiative, tactfulness etc. Of course, in addition to these, the general condition prevailing at the organisation as a whole, is an important determinant.

**Specific abilities involved and their measurement through Objective method.**

Hence, the method of selection of suitable hands at different levels in the industries, starting from technical

to primary level workers should be made as accurate and objective as possible. Matching individuals and jobs is important from the point of the individual's adjustment, improving the morale of workers, as these ensure better quality of workmanship which serves as a means to higher productivity for the country and happiness for the individual.

**Varying Standard of University Marks—Objective Tests Provide the Solution**

The syllabus and the standard of knowledge on part of the candidates vary from university to university, making it difficult to compare the suitability of the candidates graduating from different universities on the basis of their marks alone. Under circumstances standardised achievement and aptitude tests of the objective type can only solve this problem efficiently. Studies conducted by us and others at various places indicated that the immediate result of introducing aptitude and/or achievement tests of the objective type for selecting individuals for specific jobs or training courses, is an appreciable reduction in the percentage of wrong selection. If the efficiency of the selection procedure is increased by only 10% over what can be achieved without selection tests—a modest claim and fairly easily achievable the financial saving and other related implications would be considerably high.

Before discussing the results that have already been achieved and what can be achieved by introduction of objective methods of selection in industry, a brief introduction to the objective methods and the rationale behind them is presented below.

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### Objective tests : Rational and Utility

Individuals differ in almost all aspects one can enumerate or think of. They differ with respect to physical characteristics and capacities, level of mental ability, their likes and dislikes and also with respect to personality traits. The pattern of physical, mental and personality variables give rise to a thousand and one combinations and the particular pattern makes the individuals suitable for several classes of activities, jobs or fields of training.

Matching an individual's physical, mental and temperamental patterns with the requirements of the job or fields of training is a difficult task, but where this marriage takes place the result is happiness for the individual and greater prosperity for the society and for the nation. But instances of round pegs in square holes are not rare and cases where the allocation is not bad but much better could have been achieved, are quite frequent.

So, before deciding upon the job or jobs suitable for a particular individual, we should know about the level of his ability and knowledge, the pattern of his interests and attitude in detail. The easily available measure about the individual is his university record. But as mentioned earlier, there arises difficulty due to varying standards of evaluation which may even undergo changes from year to year.

The basic unreliability associated with essay type of examinations is responsible to some extent for this state of affairs. Even if university marks were perfectly reliable, yet it would be difficult to base personnel selection just on the basis of such marks, because university mark tells us only "thus far the candidate has achieved", it does not tell us anything as to whether he has the capacity "to go still further" or "no further". Here we may consider the concept of aptitudes which speaks about the potential ability possessed by the individual—in other words it is an indicator of the individual's trainability in specific directions or his possibility of success in a particular type of job.

The theory of mental measurement and that of aptitudes also are based, like many other aspects of an individual's mental make-up, upon the fact that individuals differ among themselves. It concerns about individual differences in the case of learning in a particular educational field or in the case of acquiring proficiencies in particular jobs. It is a fact of common

observance that one individual masters a particular type of training easily and attains a high level of proficiency, while another person subjected to the same conditions, finds it difficult to learn and eventually meets with failure. In such situations it is generally said that the first person has a special knack for that field of training or job while the second person lacks an adequate amount of it.

**Measurement of abilities—intelligence test followed by the concept of specific abilities or aptitudes**

Scientific methods of assessing such mental aspects of an individual were first used in the field of education as early as 1905 and as a result test batteries for the measurement of intelligence or I.Q. came into existence. Due to increasing specialisation and for tackling problems of allocation to diverse fields, it was however observed later on, that information regarding the I.Q. of an individual alone was not sufficient for decision-making and gradually the concept of aptitudes and methods for measuring these gained importance.

### Practical use of Aptitude Measure

During the last twentyfive years there has been a great advancement in the development of scientific methods for assessing knowledge, comprehension, scholastic ability, aptitudes, personality traits etc. As with many scientific advances there has been a considerable lag in their application, yet where these methods have been *correctly* applied it has yielded fruitful results, as observed by us from our experience in this area over the last twenty years at various public and private sector organisations.

### Nature of Aptitudes

Aptitude has been defined as a condition, a set of characteristics or combination of traits, symptomatic of capacity to acquire specific proficiencies or modes of behaviour. It should also be stressed that aptitude is not necessarily an entity, but rather a constellation of entities, the set of characteristics which enables one person to learn something may be different from that which enables another person to learn the same thing.

### General Acceptance of Objective Methods

As mentioned earlier objective methods can be used in selecting persons for executive and supervisory positions as well as for clerical, computational and similar

type of jobs. In recent times in India a trend has developed in favour of taking the help of scientific and objective methods not only for selection purposes but also for purposes of placement and promotion. This is specially true for executive and supervisory positions.

#### Validity Study takes time

It has, however, to be kept in view that evaluation of the efficiency of a selection test is a time consuming and laborious process and the predictive ability of a test battery has to be determined and improved through follow-up studies. To cut short this time lag at several places like HSL, TELCO etc., we have administered a series of short duration tests on persons already employed and have used their past records and job evaluation for finding out which factor or aspects are essential for success in those job types under the specific set up. This information is used by us for working out improved revisions of the selection test batteries.

#### The Problem of Obtaining a Criterion that is Valid as well as reliable

Follow-up studies involve a study of the relation between actual performance either in a course of training or in some job, with the level of scores earned by the individuals at the selection test. When this relation is perfect, then the correlation coefficient which is an index expressing the degree of this relationship would be 1.00, where there is no relationship then this index would be zero. With respect to follow-up study the main difficulty centres round the question of the criterion to be used for finding out the efficacy of the selections made. The criterion to be used must be easily available and at the same time it should indicate levels or degrees of success which will be relevant as well as reliable. When selection is made for a training course only, the task of getting a criterion is a simple one as we could take the examination marks at the end of the course or an average of all the marks earned by him in several examinations conducted during the course, as criterion. But when it comes to jobs where usually the confidential report is in the form of rating and specially when the ratings are made by different persons, getting an adequate and reliable criterion is a problem. Ratings can be reliable only when the raters themselves are properly trained which is rarely achieved. Hence, it is essential to evolve a scientific method of later assessment along with selections, otherwise it is difficult to achieve the maximum benefit that can result from the introduction of scientific method of selection.

## Nature of Objective Tests

The main characteristics of an Objective type of test are as follows :

1. There will be no difference in marks that a candidate receives if different examiners were used to score the papers.
2. There will not be much difference in the marks obtained by the candidates if they are re-tested with the same or similar test.
3. The objectives of the test are clearly defined so that another person working independently would arrive at the same conclusion with respect to the candidates.

#### Multiple Choice Type—Only One Form of Objective Test

So long as these objectives are satisfied, any form of examination can be identified as of the objective type. The objective test does not necessarily mean the multiple-choice type examination alone, where for each question there are several suggested alternatives, one of which is correct and others are wrong answers *suitably* selected. The multiple-choice type on the other hand, is only one specific form of objective examination.

#### Writing Objective Test Items

Construction of an objective type question paper is an art and it requires more skill and care from the paper setter than what is required for an essay type examination paper. The alternatives of the multiple choice question should be so chosen that an individual with partial knowledge or misinformation would more probably choose one of the distractor alternatives (i.e., wrong alternatives) as the right answer, while persons with adequate knowledge would be able to identify the correct one. Hence, to construct suitable alternatives adequate knowledge on part of the paper setter is necessary. The paper setter or examiner should not only know how the student would try to solve the problem but should also know at what point they can commit error due to lack of knowledge or ability and what misinformation they do usually possess.

**Not Just recall but—understanding, reasoning, writing ability etc. can also be measured**

It is a common belief that objective tests can measure only memory and recall of facts; but this is

not true and properly constructed objective tests can measure comprehension, reasoning ability, achievement in different subjects etc. It might be mentioned in this connection that the Educational Testing Service of the U.S.A. has developed such objective tests which are widely used for assessing the aptitude as well as achievement of the students in different subjects at various levels and these are used throughout the world in connection with admission to different universities in the United States.

#### Guessing in Objective Tests

With the multiple-choice objective tests there is the problem of guessing the correct answer by the candidate and it gives rise to an error which is amenable to statistical analysis and correction. The problem of guessing in objective tests occurs when the test becomes too difficult for the group. When the candidate fails to answer most of the questions, it is natural on his part to choose the alternatives at random. Only when the items are of medium difficulty, the problem on account of guessing is not a serious one.

#### Greater Number of Items ensure better Sampling of Knowledge and Higher Reliability of the Measurement

The nature of the questions and the mode of answering them permit inclusion of large a number of questions in an objective test and this provides a much better sampling of the domain being measured which accounts for much higher reliability. By high reliability the stability of the obtained results is ensured i.e., if the test is repeated similar result is likely to be obtained.

#### Evaluation is Quicker and Easier

One important advantage of such an examination is that it can be mechanically scored by means of high speed computers or even by clerical hands by using properly designed scoring stencils, and as such it does not require the use of subject matter experts to evaluate the answers, because the correct alternatives or answers are determined by the experts beforehand.

#### Main Benefits

- (a) Proper selection
- (b) Large Number can be Handled

Now let us examine what are the main benefits that can be achieved by using such tests in the fields

of trainees and/or personnel selection. As regards professional courses, our experience has been that introduction of these tests improves the quality of the trainees selected, which ensures better utilisation of the training facilities available. As the institution or organisation invests a substantial amount in terms of time and money with respect to the selected candidates during the training period, wrong selection means such wastage of money apart from the loss of the training facilities which would have been otherwise available for candidates who were more suitable. As evaluation of answer scripts with objective test does not involve much problem, it is not difficult to handle large number of applicants for purposes of selection. The initial screening instead of being based upon tedious scrutiny and evaluation of applications by staff members at a high level, can be done through a selection test for those who satisfy the minimum qualifications. This may be followed by detailed testing and/or personality assessment for a restricted group before subjecting the candidates to the interview situation.

#### Undue and Unwanted recommendations can be Effectively Avoided

One is aware of another major difficulty in connection with selections which is very difficult and embarrassing to overcome at times. These are the problems arising out of pressures from within and out side the organisation in the form of unwanted request and/or recommendations for selecting a particular candidate. We find that a reference to the candidate's performance at the selection test often serves as an effective remedy to such undue pressures. Moreover, when promotion and allocation within an organisation are based on such objective methods, results are generally found to be accepted by all concerned.

#### Personality Traits are also Related to Job Success

There are certain educational or vocational fields where just obtaining high scores on the achievement and/or aptitude tests is not an adequate indicator of future success in the job. Moreover, where promotion to a higher level is involved this aspect becomes more important. At the time of selection of candidates for executive, supervisory and for posts which involve public relation, it is necessary to select persons who not only possess a high level of ability, but also have a suitable personality pattern. So it is desirable to have some objective method of assessing these

aspects. There are several instruments available in these fields of measurement, which are mainly used for experimental and guidance purposes.

#### **Available Instruments For Personality Assessment are not Suitable for Selection Purposes**

It is a well known fact that the existing personality tests and inventories are susceptible to faking and in a selection situation where the candidate knows that he would gain only if he fakes his answers in the expected direction, there is nothing to prevent him from doing so. Experimental evidences have shown that even an inventory using the forced-choice method is susceptible to multiple faking. To overcome this difficulty, items whose vocational significance is not obvious can be used and candidates may also be instructed to answer the questions under hypothetical conditions. If the conditions are vague enough then it would be difficult for the candidates to fake their answers. Here the answers given by the candidate can be evaluated in a manner similar to the one used in case of projective tests.

Development of such instruments for measuring interests and personality traits would require carefully planned detailed research work and when such instruments become available the selection in these fields can be definitely improved.

#### **Group Task—as Personality Assessment under Selection Situations**

The method of group task developed by the Psycho-metry Unit (PRSU) provides a more or less objective assessment of Personality traits like Co-operativeness, Leadership, Ability to plan, Initiative etc., through observations and ratings made by trained raters on the basis of individual interaction during performance of the specified task.

#### **Group Task Results are Encouraging**

The Group Task mentioned above involves paper and pencil work only and it is so designed that successful completion of the task would call for lot of group planning, understanding and interaction among the group members. The task in question is not of much importance, but the behaviour and interactions among the individuals are of crucial importance for purposes of ratings. Follow-up data in this connection have just

started coming and on the basis of the small scale study that could be done till this time, we are observing that the group task ratings are more related to later performance than the marks received by the candidates on the basis of usual interview. This result is based on the performance at the training period only and we expect even higher relationship with the actual job performance of these individuals which will be available later on. Validity coefficient as high as +.79 has been obtained by us at one instance.

This method however, is a time consuming one, as we can handle a maximum of ten individuals at a time and it needs at least three raters and a period of two hours per group of ten candidates.

It may be, however, mentioned here that we have extended its use in several public and private sector organisations, as a second stage screening device after a first screening based on aptitude test scores and the results obtained are encouraging.

#### **Validity Study : Certain Sample Cases**

It should be remembered in this connection that evaluation of the efficiency of a selection test is a time consuming process. Most of the selection projects undertaken by us for the public and private sector industrial undertakings started since 1970 or even after and some have been taken up as late as 1973. The earlier projects of PRSU were mainly in the field of professional training in various fields as the ones at Christian Medical College, Vellore, Indian Institute of Management, Calcutta, and here too we obtained quite fruitful results. For selection procedures developed by us in the field of industry and associated training programme we have been able to complete the initial validity study for some of the selections done by us in 1970 and 1971. Similar studies for other organisations are in progress. Some results are presented here by way of illustration without disclosing the identity of the organisation concerned for obvious reasons.

#### **Study—A**

For the present situation, for obtaining an idea of the predictive ability of tests the existing group of engineers were used and the agreement between test scores and the confidential report for these persons are shown in the following table.

Table 1

Percentage of agreement between office record of job performance with composite grade on aptitude and group task ratings.

Aptitude & Group Task Composite Grade	HIGH	AVERAGE	LOW
Job Performance Record			
HIGH	12%	12%	0
AVERAGE	6%	58%	0
LOW	0	6%	6%

From the value presented above it is evident that there was perfect agreement between grade based on selection variables and job performance in 76 per cent cases. For the remaining 24 per cent cases, the observed difference was of one grade.

### Study B

In this case, only the aptitude tests were developed by the PRSU and the other selection variables were provided by the organisation themselves and there were interview, group discussion and application evaluation. The multiple correlation with aptitude scores with later performance as the criterion was +.60, whereas the corresponding figure for the other three variables used was +.30 only. The individual correlations with later performance as shown in table 2 would give an even better picture.

Table 2

Rank order correlation between later performance and different selection variables

Selection Test	APTITUDE SCORE						Inter-Group view	discuss-ion	Appl. Eval-ua-tion
	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6			
Later Performance									
Criterion	+.24	+.47	+.30	+.03	+.05	+.31	-.01	-.51	-.35

### Study C

All the applicants were fresh engineering graduates in branches like Mechanical, Electrical and Aeronautical. The candidates were all first class graduates securing a rank within first ten in order of merit at the final examination of their respective institutions or universities.

An objective test battery specifically developed for this purpose was used for first screening the candidates on the basis of their level of aptitude.

Those who scored above the cutting point set up for this purpose were called for a group task. Candidates declared suitable at this stage were interviewed by the organisation concerned and final selections were made out of them.

The marks obtained by these selected candidates at the end of first six months and at the close of the one year training period before actual job assignment were available, and table-3 presents the findings thus obtained. Further data relating to their job performance have just come and would be reported later on.

Table 3

Product moment correlation coefficients between selection variables and different criteria

Test	Verbal Reasoning	Following Direction	Engg. knowledge and Comp.	Q.R. D. I.	Univ. Marks	Inter-view Marks
Criterion I	-.02	+.44**	-.09	+.29	-.30	+.10
Criterion II	+.35*	-.13	+.27	-.11	+.13	+.06
Department Assessment	+.22	-.05	+.25	+.48**	+.17	-.04

\*Significant at the 5% level. \*\*Slightly below the 5% level.

It might be noted that whereas the correlation with aptitude tests are as high as +.44, +.35, +.48 with Criterion I, II and Department Assessment, the corresponding figures of the past university records were -.30, +.13 and +.17 and that for interview ratings were +.10, +.06 and -.04. The maximum correlation obtained here between criterion score and group task ratings is +.50. Higher relationship is expected with later job performance records which have been just received.

The test battery for subsequent selections in this case revised on the basis of the validity coefficients, item analysis and reliability indices and the revised test battery has been used for selection purposes this year.

The general opinion regarding the candidates thus selected in this particular organisation and elsewhere has been that these groups stand higher with respect to ability, they are more sober and well-behaved and they do not try to bluff even at the time of interview when compared to earlier groups selected without the help of objective methods.

### Study D

All the applicants here were graduates in different branches like Arts, Science, Engineering etc. and similar selection procedure as described in Study C was followed. Only the test battery was a different one to suit the job requirements. After selection the candidates were placed on job training for a year and they were routed through different allied departments for training purposes. Obtained results show a high correlation between the Departmental Assessment and test used. The highest correlation between criterion and aptitude score was +.44 and that for the personality traits assessed through group task and the criterion was +.79. As the job in question involved management position, the high predictive ability of personality ratings is quite understandable.

### Study E

In the present situation involving a professional training course, a battery of six tests was used for screening purpose; the final selection was, however, based on educational qualification, personal factor, interview evaluation and the selection test scores. The final cumulative grade point average was available at the end of two years and the predictive ability of the selection variables was observed by calculating the multiple correlation for a particular year where the number of cases was 50. The obtained results are presented in table 4.

A study of the obtained multiple correlations under the three conditions show that the aptitude marks have significant role in enhancing the predictive value of the selection procedure. The contribution of the other three variable is not statistically significant.

### Study F

This study refers to a training course where six different tests were used. The product-moment correlation between the examination mark obtained by the candi-

dates at the end of the course and the composite selection marks were obtained for six batches of trainees and these are presented in table 5.

Table 4

Regression coefficients, multiple correlation etc., of the selection variables against the final grade point average earned by the candidates (N=50)

Variable	Regression Coefficients		
	First three Variables	Next Six Variables	All nine Variables
Educational Qualifications	.27	—	.55
Personal Factor	.39	—	.20
Interview Evaluation	.04	—	.03
Test-1	—	.00	.00
Test-2	—	-.08	-.07
Test-3	—	.04	.03
Test-4	—	.02	.01
Test-5	—	.09	.10
Test-6	—	.01	.02
L	455.30	427.42	308.07
Multiple Correlation	.30	.65**	.69**

\*\*Significant at the 1% level.

Table 5

Product-moment correlation coefficient and the criterion scores for the 1956 to 1962 batches of trainees.

The year in which the batch of trainees were admitted.	Correlation of the selection score with annual examination marks.
1956	.60
1957	.52
1958	.59
1959	.42
1960	.47
*	
1962	.42

\* As number of trainees was quite small for 1961 no figure for that year is presented.

## Study G

As in study A here also for obtaining the predictive ability of the selections, the test battery was used on a group of engineers already working and the regression weights, product-moment correlation and multiple correlations showing the agreement between weighted test scores and the confidential reports for these persons are presented in Table-6.

Table 6

Product moment or between test scores and the two criterion used along with the regression weights for different tests and multiple correlation.

TESTS	CRITERION-I (Confidential Report)		CRITERION-II (Assessment of Tech.Kn. by the Orgn.)	
	Correlation	Regression Weights ( $\beta$ )	Correlation	Regression Weights ( $\beta$ )
1.	.099	-.0180	.216	-.0142
2.	.512**	.1429	.400*	.0906
3.	.376*	.1860	.086	-.0086
4.	-.080	-.1149	.123	-.0611
5.	.119	-.0978	-.022	.0034
6.	.205	.0881	.493**	.0566
7.	.171	-.0239	.337	.0267
8.	.317	-.1275	.267	-.0245
9.	.174	.0571	.146	.0015
10.	-.155	-.0120	.102	.0627
	—	4.2781	—	2.2299
Multiple Correlation (R)-		.960**	—	.713*

\*\* Indicates significant at the 1% level & \* at the 5% level.

From the figures presented in table-6 it follows that there exists a significantly high relationship between weighted test scores and actual job performance. This ensures that job performances can be correctly predicted with a high degree of accuracy on the basis of objective methods of selection.

## Conclusions

From what has been said earlier and from the follow-up results presented for some of the studies made the relative gain by introduction of objective methods of selection is quite convincing. Here we would like to emphasize the point that the success of a selection procedure depends not only on the validity and reliability of the selection tests but also upon the quality of the criterion measure. It is generally observed that the need for scientific job evaluation (i.e., criterion) has not yet obtained its due importance from the employers of our country.

It is encouraging to note that in recent times scientific methods of selection are being increasingly used, but unless the selected ones are evaluated properly and are given due recognition and proper incentive for the quality of their work, not much gain would result just by selecting the best persons. Proper job evaluation is a must, and should form an integral part of the selection policy of an organisation. Similar initiative as observed with respect to introducing objective methods of selection, is also needed on part of the organisations concerned in developing scientific procedure for later job evaluation.