CHAPTER NO.III
EARLY ATTEMPTS TO MEASURE SCIENTIFIC APTITUDE

Though the concept of 'aptitude' came into existence very late, the desirability of having tests of behaviour, which indicate in advance latent capacity is very ancient. As quoted by Hull, it appears repeatedly in Platos' Republic. According to Hull,

"Plato proposed that persons being considered for the military profession should be given 'actions to perform' which would test the retentiveness of their memories, their power of resistance to deceptions, or resistance to timidity and fear in terrifying situations, and to the seductions of pleasure." 1

Plato, thus sketched forth very definitely a set of tests for military aptitude which came into real existence some twenty three hundred years later. The modern forms of aptitude tests came into use during the world-war I; while world war II stimulated the production of aptitude batteries.

The prewar primary mental ability batteries were followed by a number of tests measuring aptitudes of subjects

in a variety of fields. By 1930, we see the constructions of aptitude tests for telephone girls, street car motormen, tests of mechanical aptitude, musical aptitude, art aptitude, clerical aptitude and aptitude for various subjects taught in secondary schools and universities. A number of aptitude batteries came in existence. Some of the prominent batteries are:

1. Reader and Graham's Aptitude Tests for occupations.
2. Segal and Ruskin's Multiple Aptitude Tests.
3. General Aptitude Test Batteries
6. Yale Educational Test Battery
7. Scholastic Aptitude Tests.

Looking to the above works in this field, comparatively less work has been done for the measurement of 'Scientific Aptitude' in particular. Some recent and prominent efforts in this direction are:

2. Physical Science Aptitude Examination.
3. Iowa Placement Examinations in different Science subjects.
5. Hunter Scientific Aptitude Test.
REVIEW OF ATTEMPTS TO MEASURE SCIENTIFIC APTITUDE:

It would be appropriate in the context of the present work to review some of these attempts to measure scientific aptitude.

In 1929, Dr. D. L. Zyve constructed a scientific Aptitude Test which was published by Stanford University Press of California. The test is known as 'Stanford Scientific Aptitude Test.' It contained the following sub-tests:


There is no time-limit to sub-tests but the overall time-limit is 2 hours. Different weightage has been given to different exercises. The test has been validated against external criterion and validity is found within the range of .50 to .74 by different methods.

A number of test batteries were published by Bureau of Educational Research Service of State University of Iowa during 1925 to 1944 in the name of 'Iowa Placement Examinations' in different science subjects. The common sub-tests contained in the above tests are:

In most of these tests, time-limit is given for each sub-test and weightage has been given to different sub-tests. Only predictive validity has been calculated for some of the tests which has been found satisfactorily high.

After some period, science talent search was conducted by science clubs of America and was administered by Science service for Westinghouse Science scholarships and awards. This science aptitude examination mainly consisted of the following sub-tests:

1. Scientific information, 2. Comprehension, 3. Numbering, 4. Formula and 5. Figure.

There is no separate time-limit for sub-tests, but the overall time-limit for the test is two and half hours. No data about the validity of this test are available.

In 1942, the Psychological Corporation of New York published 'Engineering and Physical Science Aptitude Test' which contained the following sub-tests:


Its validity coefficient has been estimated as .73 with grades in war emergency training and it has been suggested that it should be validated in terms of the situation in which it is to be employed.
Recently, two forms of Hunter Scientific Aptitude Test have been published by Hunter College. Each form of this test contained the following sub-tests:

(1) Recall of information, (2) Assigning meanings to observations, (3) Applying principles in making predictions and (4) Use of scientific method.

The reliability coefficient of two forms is reported as .64. Its validity coefficient with science Achievement Test varies within .74 to .77; while that with science teachers' ratings varies within .67 to .68.

APTITUDE TESTING IN INDIA:

In India, educational and psychological testing has a very short history. A number of tests have been prepared by some guidance Bureaus and University Departments of Education. But most of these tests are in the area of achievement and intelligence and very few in the area of Aptitudes.

Most of the aptitude tests in India have been constructed by M.Ed. candidates as a part fulfilment of the M.Ed. A. About nineteen tests of aptitude have thus been constructed by 1961. They are classified as under:
Professional Aptitude - 7
Mechanical aptitude - 5
Mathematical Aptitude - 3
Science aptitude - 2
Scholastic Aptitude - 1
Musical Aptitude - 1
Total... 19

These tests have not been printed and not used also. But apart from the above tests, few tests of science aptitude have been developed by University departments of Education and some research organizations. They are:

1. Science Aptitude Test (Educational and Vocational Guidance Bureau, Bihar)

2. Scientific Aptitude Test (Bureau of Educational and Psychological Research, Calcutta).

3. Scientific Aptitude Test Battery (Central Bureau of Educational & Vocational Guidance, Delhi).

4. Non-verbal science Selection Test - by Roy Chaudhry. (Measur (Manasayan, Delhi.)

5. 'Science Aptitude Test' for the project of Science talent search (N.C.E.R.T., New Delhi)
Shri S.M. Mohin constructed two parallel forms of Science Aptitude Test for Std. VIII to XI which have been published by Educational and Vocational Guidance Bureau, Bihar. The test-form contains three sub-tests with the total time-limit of 33 minutes. The reliability coefficient varies within .87 to .89; while its validity coefficient with the external criterion is estimated as .76.

The other scientific Aptitude Test has been recently published by Bureau of Educational and Psychological research of Calcutta. It contains 36 items under six sub-tests with an overall time-limit of 40 minutes.

In 1959, Manasayan of Delhi published a non-verbal Science Selection Test for the pupils of Std. IX of Secondary School. The test is composed of three parts:

1. Scientific comprehension test,
2. Space relation test and

Each sub-test has a separate time-limit. The reliability coefficient estimated by different methods is found within the range of .80 to .84; while its validity coefficient calculated with external criterion is found within the range of .70 to .90.

The central Bureau of Educational and Vocational guidance, Department of Psychological foundation of
National Council of Educational Research and Training, Delhi is working a Scientific Aptitude Test Battery. It contains the following sub-tests:


The test is under standardization and no further details are available regarding the same.

The National Council of Educational Research and Training of New Delhi launched a project of science talent search during the year 1962-63. To locate the potential science talent, the Council constructed a 'Science Aptitude Test'. The entire test consists of 165 items out of which 88 items are of a factual type, while the remaining 77 items are of thought type. The time-limit for the test is 3 hours. The reliability of the test is estimated as .94 by K - R method and its validity with the examination marks is reported to be .5.

GENERAL CRITICISM ON TESTS OF SCIENTIFIC APTITUDE:

A lot of criticism has been levelled against most of the tests of scientific aptitude constructed till now. Some of the common points of criticisms against scientific aptitude tests are:
1. There is a lack of clear meaning attributed to the word 'Scientific Aptitude'. In some tests, the concept of 'Scientific Aptitude' is confused with 'Scientific Achievement'.

2. Their validity is of doubtful nature as no external criterion have been fixed before constructing the tests. In most of the tests, the validity of the individual items has not been tested before they are included in the test form.

3. The scores on these tests correlate appreciably with scores on general scholastic aptitude tests and intelligence tests; and thus they fail to differentiate between scientific aptitude and general scholastic ability of the pupils.

4. They place too much weight on rate of work, thus adversely affecting their predictive value. As Freeman states, "If a prognosis test is to predict potential power, the speed factor should be eliminated."

5. Some of the tests measure a fairly large variety of factors believed to be associated with success in the study of science and engineering. This is not fair.

6. Most of the tests are standardized on a small sample of groups and so the reliability and validity data

supplied are limited and the interpretation of the scores is left almost entirely to the user.

IMPACT OF STUDIES OF EXISTING TESTS ON THE PRESENT WORK:

The review of the work done in the past on measurement of scientific Aptitude and of the criticisms against the same will have no meaning if it is not considered while constructing this new test for measuring scientific aptitude. The review shows that though some efforts have been made to devise valid tools to measure 'Scientific Aptitude', there is a pressing need for a reliable and valid tool to measure 'Scientific Aptitude'.

The present work is profited a lot by the study of the tests that have been constructed till now. In the present work, the investigator has tried to avoid almost all the criticisms cited against the tests constructed in the past. How the plan for the construction and standardization of the present test is based on the study of the past tests and how this plan has profitted by the criticisms levelled against them is discussed in the following chapters.
SELECTED REFERENCES


Journals & Reports:


