"... an intelligent woodsman may be just as intelligent as an intelligent college professor."

- Michael Merbaum
& George Stricker

CONTENTS

2.1 The Pre-Scientific Stage
2.2 The Scientific Stage
2.3 Performance Tests
2.4 Group Tests of General Ability
2.5 Development of Tests in India
2.6 Development of Tests in Gujarat
2.7 Rationale for the Present Test
DEVELOPMENT OF GENERAL ABILITY TESTS

Differences in general ability among children and adults have been observed throughout history. Since then, efforts of measurement of individual differences have been made by developing different types of tests.

Development of general ability tests can be studied under two stages:

1. The pre-scientific stage, and
2. The scientific stage.

2.1 The Pre-Scientific Stage:

In France, Jean Esquirol (1772-1840) tried for the first time to differentiate between mental deficiency and mental illness. Thereafter in 1860, Francis Galton, the English geneticist and eugenicist, invented methods of measuring physical characteristics, keenness of the senses and mental imagery. Galton's methods, though not developed fully, served as models for later tests. At that time, psychology did not develop as an objective science.

In 1879, Wundt opened the first psychological laboratory in Leipzig and tried to establish quantitative psychological laws by working with his colleagues. Even though the general laws formulated by them had little to do with individual differences, the Leipzig-laboratory procedures influenced the early testing movement strongly.
In U.S.A., J. McKeen Cattell was using a mixture of procedures from Wundt's and Galton's laboratories in 1890. Cattell was the first interested in the range of individual differences. The following 10 tests of Cattell\(^1\) were considerably regarded during that period:

1. Measurement of strength of grip, using the dynamometer.

2. Measurement of rate of movement: the quickest time in which the hand can be moved.

3. Measurement of the smallest distance between two points placed on the skin.

4. Measurement of the amount of pressure necessary to cause pain.

5. Measurement of the smallest amount of difference in weight which can be discriminated.

6. Measurement of quickness with which a person can react to a given time.

7. Measurement of quickness with which a person can name four different colours from ten specimens.

\[---\]

8. The accuracy with which a person can bisect a fifty centimeter line.

9. The accuracy with which a person can reproduce an interval of ten seconds.

10. Immediate memory of the number of consonants spoken to an individual.

From the above mentioned ten tests, it could be traced that most of them were simple sensory and motor tests with a little addition of rote memory.

On the similar methods and materials, some other investigators also had developed testing material. Jastrow prepared tests involving touch, vision, memory and reaction time. Boas made tests for physical measurements of children and obtained teachers' estimates. Gilbert gave tests measuring height, weight, lung capacity, sensation, memory, suggestibility, etc. Kraepelin and Oehrn in Germany developed tests to measure perception, memory, association and motor functions.

Muensterberg developed more complex and varied tests, introducing speed factor. The tests were devised on various factors like: loud reading; naming colours, animals, plants and minerals; classification of cloth, food, parts of the body, geometrical figures; memorisation of digits and letters; location of sounds; construction of various figures; etc. Wissler's study in 1901, discouraged him in applied
psychology. However, his brief tests were proved to be unreliable.

In India, too some type of testing was prevalent. A variety of puzzles and conundrums were set before the scholars and officers in the courts of Hindu kings and 'darbars' of Muslim kings and instant solutions were expected.

Thus, the early movements in measurement of mental ability could be traced out, but the experiments were not perfectly scientific. The objectivity in testing was still to emerge. Still, however, the outline of the pre-scientific stage provides a background to compare the early efforts of psychological testing with scientifically developed testing.

2.2 The Scientific Stage:

The twentieth century began with scientific approaches in the measurement of general mental ability. The pioneering contribution of Alfred Binet and Theophile Simon will be noted in golden words in the history of testing and Binet will be recognised as the father of the scientific approach.

(a) The 1905 Binet-Simon Scale:

In about 1890, Binet, a French physician became interested in studying judgement, attention, and reasoning. His interest in the complex mental processes led him to try a great variety of tests.
In his studies between 1893 and 1911, he tried to find out how bright and dull children differed.

In the year 1904, Binet got an unique opportunity to apply his views, when he was invited by the minister of public instruction of French Government to assist in producing a scale for differentiating genuinely dull children. Binet's scale, which drew on his earlier studies was published in collaboration with Simon in 1905. It consisted of 30 tests arranged in order of difficulty.

(b) The 1908 Binet-Simon Scale:

The 1905 Binet-Simon Scale consisted of oral questions and answers. Several psychologists tried it in Europe and offered criticisms and suggestions. Thorndike labelled it as 'Standardized Interview'. Binet and Simon accepted suggestions and revised the scale. The new scale consisted of 59 items. The 1908 Binet-Simon Scale provided relatively complete age-grade data so that individuals taking test could be classified with an age-group according to the ability to perform the tasks, and also in the grade group which corresponded to his over-all performance. For the first time, the concept of mental age was employed in the test.
(c) The 1911 Revision of the Binet Scale:

The 1908 scale created interest among psychologists in Belgium, Germany, Switzerland, Italy, United States and England and they came with number of suggestions for revision. The 1911 revision of Binet Scale resulted with the following major changes:

1. Some of the test items were dropped,
2. certain items were transferred to suitable age-groups, and
3. the method of scoring was modified.

Binet's Scales of 1908 and 1911 stimulated the psychologists of the other countries, who utilized Binet's principles and drew freely from his tests.

(d) The Stanford Revision of the Binet Simon Scale, 1916:

L.M. Terman directed to revise Binet Simon Scale at the Stanford University in 1916 for providing a tool to be used in United States. The scale consists of 90 test items, covering an age-range from 3 years to 14 years. From the revision of 1916, it can be noted that no new concepts have been added. Terman and his colleagues extended, refined and adapted Binet Scales and Standardized in their country.

(e) Other Revisions:

Various revisions prove Binet's work a great landmark in the history of mental testing. Some of
other revisions of his scale are those of Goddard (1911), Kuhlmann (1912, 1922 & 1939), the point Scale of Yerkes, Bridges and Hardwick (1915 & 1923), Herring's Revision (1922), and Cyril Burt's London Revision (1921).

(f) The 1937 Revision of Stanford Binet Scale:

The 1916 Simon Binet Scale was replaced in 1937, when Terman and Merrill published Forms L and M of the Stanford Binet. These tests improved upon the construction and offered two comparable forms.

(g) The 1960 Revision of Stanford Binet Scale:

In this revision more effective items have been retained and rearranged, and deviation IQ has been introduced. As Cronbach states, "The latest revision of (1960) combines the best tests of the 1937 revision into a single Form L-M and improves and updates the scoring system. In all parts of the world there have been other versions taken directly from the Binet test or one of the Terman revisions." 2

There are two limitations of the Binet's Tests:

1. Being verbal tests, they cannot be administered to the illiterate, deaf and mute, and

2. being individual tests, they consume a great deal of time.

To minimize these limitations, two types of tests have been developed. They are (1) Performance Tests and (2) Group Tests.

2.3 Performance Tests:

One of the earliest of performance tests was the Form Board Test developed by Seguin in 1866 for mentally retarded children.

A number of other performance tests were developed in 20th Century. Some of the noteworthy tests are Healy-Fernald Tests (1911), Knox Cube Test (1914) for testing foreign immigrants in United States, Pinter-Paterson Scale of Performance Tests (1917), The Koh's Block Design (1923), Porteus Maze Tests (1914, 1924, 1950 & 1959), Arther Point, Scale of Performance Tests (1930), Alexander's Passalong Test, Collins & Drever's Performance Tests.

The Wechsler Scales

Although administered as individual scales, these scales differ in several ways from earlier tests. All the items of a given type are grouped into sub-tests and arranged

in increasing order of difficulty within each subtest.

Another feature of these scales is the inclusion of verbal as well as performance subtests from which separate verbal and performance IQs are computed.

The major competitors of the Stanford-Binet are the Wechsler Scales. The first form of the Wechsler Scales was published in 1939. In 1949, the Wechsler Intelligence Scale for Children (WISC) was published. It is designed for ages 5 to 15. In 1955, the 1939-Wechsler-Bellevue Scale was revised and renamed as the Wechsler Adult Intelligence Scale (WAIS). The latest is the Wechsler Preschool and Primary Scale of Intelligence (WPPSI) published in 1987 for ages 4 to 6½. The deviation IQs for the tests have been computed.

2.4 Group Tests of General Ability:

Because of economy and practicality, group tests are used extensively now-a-days. Group tests are non-verbal, verbal or mixed type of tests. During World War I, the committee under Yerks in United States felt the need for classification of recruits. By that time Otis, Thorndike, Pyle and Pinter had adopted group mental testing. The army psychologists took as a nucleus the work of Otis and Terman and prepared two types of group test of intelligence, known as The Army Alpha (verbal) and The Army Beta (nonverbal) Tests.
After World War I, the group tests were released for general use; they passed through many revisions. Increasing popularity in those days gave impetus to construction and standardization of group tests of general ability. Brief outline of the group tests is given below.

**Note-worthy Group Tests**

1. **Army Alpha Examination (1916, 1939)**:

   It is meant for the use of secondary school children and adults. It consists of several speeded sub-tests, calling for information, reasoning, and practical judgment.

2. **Army General Classification Test (AGCT) 1945**:

   It was developed during World War II and was administered to over ten million inductees. The items based on vocabulary, arithmetic, reasoning and block counting are arranged in spiral omnibus form.

3. **California Test of Mental Maturity (CTMM) 1936, 1957 & 1963**:

   It is developed by Sullivan, Clark and Tiesg with variety of items. The test is widely accepted currently.

---

4. **Co-operative School and College Ability Tests (SCAT)** (1955):

A verbal score measures vocabulary and reading comprehension and a quantitative score measures arithmetic reasoning and operations. Both measure school learned ability.

5. **Culture-Free Intelligence Tests (1933, 1944, 1950)** by R.B. Cattell:

The tests are meant for age range from four to adult. They are non-verbal tests including matrices and other reasoning tasks.


The test is a 30 minutes' test of spiral omnibus pattern, for ages 3 to 12. The items include information, proverb interpretation, analogy, following directions etc.

7. **Kuhlmann-Anderson Intelligence Tests (1927, 1952)**:

It is meant for age 6 to maturity. The development of this scale is characteristic of the procedures used in older group tests.

8. **Devis-Bells Games (1953)**:

It is for the age group 1 to 6, with pictorial items.
9. **Lorge-Thorndike Intelligence Tests (1954)**:

   The test is meant for K.G. to High School children. The items consist of verbal and non-verbal items.

10. **Otis Quick Scoring Mental Ability Tests (1920, 1930, 1954)**:

   They are meant for grade I to College level. The tests are composed of verbal and non-verbal reasoning items to obtain a quick measure of general ability.

11. **Pinter General Ability Tests (1931, 1941)**:

   The test is meant for grades 4 to 9. There are separate language and non-language tests.


   It is a non-verbal test for ages 5½ to 11.

13. **Semantic Test of Intelligence by P.J. Rulon (1952)**:

   It is a non-reading test for testing conceptual reasoning.

14. **Terman-McNemer Test of Mental Ability (1940, 1949)**:

   It is meant for grades 7 to 12. It is a verbal test restricted to reasoning and information.
15. **Tests of General Ability (TOGA) (1957-60)**:

The tests are developed by J.C. Flanagan for grades K.G. to 12. The tests represent a relatively new departure by attempting to eliminate school learned skills. *TOGA Part-I (information) Scores appear to relate more closely to Thurstone's verbal comprehension factor and Part II (reasoning) seems to his reasoning factor*. 5

16. **Otis-Lennon Mental Ability Test for K.G. to 12th Grade.**

17. **SRA Tests of Educational Ability (1962)**:
   for grades 4 to 12.

2.5 **Development of Tests in India**

In India, Herbert Rice of Lahore translated Binet-Scale into Hindi in 1922 and established norms by administering the test to about 1488 children. In 1927, Maury of Allahabad adapted verbal group tests in Hindi, English and Urdu. L.S. Jha adapted simplex Mental Test in Hindi, in 1934. By that time, Dr. Kamat adapted the Stanford-Binet Tests in Marathi and Kannada and published in 1934.

During the World War II, Army Employment Bureau developed some group tests with the help of university

departments of psychology. But after independence, number of tests were developed in various Indian languages. Some of the Indian workers in the field are Nafde, Jenkins, Raven, Ram Nath Kundu, Shukla, Draper & Vicary, Prem Latha, Jalota, Bhatia, Sohanlal, Mehta and others.

2.6 Development of Tests in Gujarat:

In Gujarat, the pioneering work in test construction was done by Dr. W.N. Shukla. In 1950, he constructed Individual Tests of Intelligence and standardized on the children of Gujarat. Thereafter, Dr. K.G. Desai published Group Tests of Intelligence in 1955.

According to the sources available, the following tests have been standardized to measure general intelligence of the children of Gujarat:

1. Dr. N.N. Shukla's Individual Test of Intelligence.
2. Adaptation of Stanford-Binet Individual Scale by Dr. M.C. Bhatt.
3. Adaptation of Wechsler Scale by Dr. M.C. Bhatt.
4. Adaptation of Wechsler Scale by Dr. J.H. Shah
5. Dr. Desai's Group Test of Intelligence.
6. Dr. C.L. Bhatt's Group Test of Intelligence.
7. Group Test of Intelligence by Prof. T.P. Lele.
8. Adaptation of Goodenough's Draw-a-man Test by Dr. P. Phatak.
9. Dr. G.B. Shah's Non-verbal Group Test of Intelligence.
10. Dr. D.M. Bhavsar's Non-verbal Group Test of Intelligence.

11. Dr. J. Patel's Group Test of Intelligence

12. Dr. M.M. Patel's Non-verbal Group Test of Intelligence.

2.7 Rationale for the Present Test:

The need of mental testing has been greatly felt, now-a-days by the teachers, administrators, counsellors and parents. But when compared to the development of different types of tests in advanced countries, work done in India seems to be less. Hence, the present investigator has modestly ventured to develop one more test along with a very few existing non-verbal tests for the children of Gujarat State.

On classifying the available tests on the basis of types, age-levels, grades, content, etc., it was observed that a very few non-verbal group tests exist in Gujarat. It was also felt from the review of the development of tests in India and abroad that it was essential for the group tests of general ability to consider some of the factors like time-limit, number of sub-tests, assigning due weightage to environment alongside heredity for performance of mental tests.

As Anastasi puts it: "A practical difficulty encountered with separate sub-tests is that less careful examiners may
make timing errors. Such errors are more likely to occur with several short time-limits than with a single long time limit.\(^6\)

To eliminate this difficulty, the test ought to utilize less number of sub-tests and minimum possible time limit.

As to the role of heredity and environment in the determination of individual's general mental ability Ebil, Noll and Bauer state:

"The belief that intelligence is completely dependent on genetic influences without appreciable change by environmental factors is now seldom held. The current tendency is to give both heredity and environment some of the credit for performance of intelligence tests.\(^7\)

Widely popular Tests of General Ability of United States, were found unique in including all the elements discussed in the foregoing paragraphs. J.C. Flanagan advocating for this writes:

---------------------


Items measuring information and reasoning were selected for inclusion in the Tests of General Ability for two reasons. First, it appeared that these two abilities are dominant in most of the definitions of general intelligence. Secondly, a review of the literature indicates that these two abilities usually provide the best predictions of school success.8

It will be in fitness of things to bring to light inclusion of much wanted elements in the test. By including 50% of the information items, the effect of environment in determining general ability has been duly considered. Information part of the test is designed to test pupil's familiarity with the world around him through experiences at home, in school, and in the community. The problems relate to general knowledge of his surroundings, gained through his deep observation of the surrounding environment. The reasoning part avoids any cultural content and tests the pupil's powers of abstract reasoning, which is very similar to genetic differences in general ability which are inherited and affect the individual's performance throughout life.

The equal weightage given to reasoning and information factors supports the current tendency, and the investigator will put forth first test of this type for the children of Gujarat. It is felt that more number of sub-tests in group tests adds to the difficulty in administration, and moreover the growing generation finds it difficult to take

---

test for a longer time. The present test pictorial in form, with two sub-tests and demanding about 45 minutes for administration might be considered unique.

With a few of the characteristics like this, the test is expected to serve as a tool to measure individual differences of children of classes VIII, IX and X in their general ability.