PART II

Test Construction

First, Second Try Out and Final Run

CHAPTER IV

CONSTRUCTION OF THE TESTS

"Planning is an essential activity in all stages of test construction".

Lindquist.[1]

Tests are constructed for administering them to a population or a section. Thereof and as such planning plays a dominant role. Lindquist further tells us that test planning encompasses all the many operations of an outline or a table specifying the contents or operations to be covered by the test, but it must also involve careful attention to item difficulty, to types of items, to directions to the

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1 Lindquist, E.F. : Educational Measurement. American Council on Education, Washington, D.C., 1955. p. 159.

examiners to arrange for try out, to problems of test reproduction, to provision for expert review, to the provision of adequate equipment and facilities.[2]

Binet, as early as 1890, proceeded to measure intelligence on the assumption that intelligence could be measured through the measurement of memory, reasoning, and judgement, etc. His earlier observations led him to the conclusion that intelligence development begins with the lower functions which may attain high and almost complete degree of evolution at a time when the higher functions are still in a rudimentary state. He collected larger number of tests, which he thought to be useful in differentiating the intelligent from the unintelligent.

Burt holds that the most efficient tests of intelligence will be those that elicit the most complex mental process which the subject is capable of.

Having noted the experiences of some of the experts, let us turn to the job in hand. Construction and administration of a test require a good deal of pre-planning and pre-thinking. Any one who wants to

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2 Ibid., p. 159.

consturct tests should be aware of the steps through which the process of standardization develops. The steps in a better form are as under:

1. To decide the contents of the tests.
2. To select the form of the test and various content items.
3. To check up the items for clarity of communication
4. To frame the instructions and fixing the procedure for administration.
5. To study the items for their validity, discriminability and difficulty.
6. To test the validity and reliability of the final test.
7. To chalk out the scoring system.
8. To develop norms for practical use.

The present chapter is confined to the first four steps.

1. Areas of the Contents of the Items

What should be the contents of an intelligence test ? That, of course, will depend upon what we take of intelligence itself. If we base our planning of the test on the definition of the intelligence that "intelligence is what the tests measure, then we would

enter into a vicious circle. On the other hand, if we lay stress on the power of thinking, judging, reasoning and such other complex processes of the human mind, the scale is turned to the other side.

We do not want to enter into learned discussion and accept the general concept of intelligence as being a complex of various primary and general abilities. Then, it would be possible to construct tests that would discriminate between the lower level of intelligence as against the upper level.

As the task in hand relates to a wide population covering wider sections of the community, we should put down the area of contents to the primary abilities at the common level.

Along with the area of contents spreads the area of age group that may be taken up for the tests.

In age group 3 to 5, the infants of the Kindergarden, could be easily brushed aside for the purpose. The next stage of primary education also would not claim much attention as the abilities to be tested would be at an unpredictive level, in most cases.

The age group 12 + to 16 - seems to be most welcome in many respects as is clear from the reasons stated below:

1. This is the age group of the adolescent.

2. During this period, pupils complete their middle school education and have to choose the line for multipurpose sections.

3. This is the period when children try to become helping hands to the income of the family especially in the rural areas.

4. Here is the age when choice of a trade, academic side or a technical branch may be required to be made.

5. As tests in the U.S.A. have shown this is an age that is full of predictive capacity, abilities shown in this stage are clearer, more definite and more specific.

6. In a country like India with its primary stress on agricultural economy, its high illiteracy and unemployment, lower levels of intelligence could be profitably employed for manipulative jobs on the one hand and the higher level could be the source for scientific manpower, the dearth of which is glaring.

7. Problems of delinquency of indiscipline, of moral turptitude and the like would be solved or at least attended to better if the levels of intelligence could be defined in general.

8. Thus socially, economically, morally and nationally, 12 $^{+}$ to 16 $^{+}$ is the most attractive age group. This age group is more convenient for administration of the test as the pupils in this group can suitably respond to verbal tests.

Locality

Area of activity has three aspects. The area of contents of the test, the area of age-group to which the test would apply and the geographical area of the population concerned. The first two are already fixed in the above paragraphs. Here investigator would prefer the geographical area of the state of Jammu and Kashmir in general and some schools in particular.

The Present Study : The Basis for

(a) Type of the test: Individual and Group Tests
(b) Verbal, Non-verbal and Performance Tests.
(c) Form of the items.
(d) Standard foreign and Indian tests.
(e) Some common forms
(f) Writing the items of various types
(g) Arrangement of the language of the test items.
(h) Check up of the language of the test items.
(i) Description of the sub-tests.
(j) Summary

(a) Individual Vs. Group Tests. - Individual tests are more diagnostic and reliable. They can be profitably employed when an individual is concerned.

Group tests on the other hand, are meant for and administered to a group with specific intention. A

class situation is a specific area. The school population is a specific group.

Thus group tests are preferable when a wider population is concerned, when the investigation is meant for general observations. As the present study is undertaken with the definite objective of classifying the students on the basis of their intelligence so that efficiency of educational administration could be improved, more adequate apparatus would be available for guidance and selection.

Since our purpose needs the testing of a larger number of students, our choice is naturally for a group test which can be administered easily to a larger number of children within a short period.

Moreover, a group test is useful and economic in a country like ours where the testing movement has no roots in organised research. Naturally, there is a great dearth of well constructed standardized intelligence tests, whether verbal or non-verbal.

(b) Verbal, Non-verbal and Performance Tests. - Second issue to be decided in selecting the type of the tests refers to the medium of expression of intelligence. In other words, it refers to whether the tests should be verbal, non-verbal or the performance type.

In the Performance Test, the ability to read and write in any language is not required on the part of the testee, an illiterate individual stands on a par with literate person. These tests usually involve

manipulation of certain patterns with the help of the given material in a prescribed manner.

Cattel[3] suggests non-verbal and performance tests for children between 4 to 8 and considers them valid for the deaf and the dumb especially. Our choice naturally lies with the verbal lot as we are concerned with school going children who are accustomed to written examinations. Thus to make the battery more valid it was decided to construct verbal tests.

(c) Form of the Items. - The problem of construction of items for the test is linked up with the form of items. The form may be useful for general routine testing or for discriminating the difficulty level or for survey purposes. The very items would assume a different role on changing their form.

(d) Some Types of Items in Foreign and Indian Tests. -

(1) The Binet Test of Intelligence. - In collaboration with Simon, Binet published his scale in 1905. This scale known as the 1905 scale consisted of thirty problems or tests arranged in ascending order of difficulty by administering the tests to 50 normal children aged 13 to 11 years and to some retarded

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3 Cattel, R.B. : "Guide to Mental Testing" University of London Press, London, 1948.p. 80.

and feeble minded children. These tests were constructed with a view to measure students' judgement, comprehension and reasoning powers which Binet and Simon regarded as essential components of Intelligence. Although sensory and perceptual tests are also included, a much greater proportion of verbal content is found in this scale than in the most test series of time. In the second or 1908 scale, the number of tests was increased, some unsatisfactory tests from the earlier scale were eliminated and all tests were grouped into age levels. The tests were constructed particularly for the pupils between 3 + and 13+ . For three years level tests were prepared which 4 years old normal pupils could attempt correctly and so on to age 13 . The child's score on the test could then be expressed in " Mental age", i.e. the age of normal children whose performance be equalled. A third revision of Binet's scale, was published after his untimely death. In this scale, no fundamental changes were introduced. Minor revisions of specific tests were made. Right from the time of its first appearance, Binet test attracted the attention of many Paychologists throughout the world. Translations and adaptations appeared in many languages.

(2) Otis Group Intelligence Scale Advanced Examination Form A and Primary Examination Form B. - It is one of such test batteries as are especially useful when a large number of persons are to be tested within a short time. Otis devised tests when United States

entered the First World War in 1917. The test was finally developed by the Army Alpha and Army Beta. The form was designed for general routine testing; the latter was a non-language scale employed with illiterates, with foreign born recruits who were unable to take a test in English.

Both were suitable for administration to large groups.

Shortly after the termination of World War I the * Army Tests were released for civilian use. Not only did the Army Alpha and Army Beta themselves pass through many revisions, the latest of which are even now in use, but they also served as models for most group intelligence tests. It consists of eight tests printed in the form of questionnaire.

(3) Stenford-Binet Tests:- Even prior to the 1908 revision, the Binet Simon tests attracted wide attention among paychologists throughout the World. Translations and adaptations appeared in many languages. In America, a number of different revisions were prepared the most famous of which is that developed under the direction of L.M. Terman at Stanford University, and known as " Stanford- Binet". It was in this test that Intelligence Quotient (I.Q.) or ratio between mental age and chronological age was first used. The latest revision of this test published in 1937, is widely employed even today.

(4) Northumberland Mental Tests and Moray. House Tests by Godfrey H. Thomson:- Group tests of the verbal variety were developed in England very extensively after 1920. All the well-known British psychologists have made their contributions in this field. Prof. Godfrey H.Thomson produced a number of well-standardized intelligence tests, first under the name of Northumberland Mental Tests and later under the name of Moray House Tests. These tests are extensively used particularly in school surveys, by the different school authorities and yield very accurate results.

(5) Group Test Series - National Institute of Industrial Psychology, London.- The test series was prepared under the general guidance of Dr. Charles Meyers. These tests are used for vocational guidance, and these are the models of good psychological tests. This series includes items like analogies, similarities opposites and reasoning.

There are also some such items as involve the detection of absurdities and the completion of sentences.

(6) Revision of Army Alpha Tests. This test includes oral directions, Arithmetical problems, practical judgement, synonym-antonym, disarranged sentences, number series completion, anologies and general information as the test items. Army alpha

tests were designed for the screening and general classification of military personnel in the first and second World Wars. Later they were used also in civil life - The original military forms of the Army Alpha (cf 27, Part II, Ch. 4) were validated in terms of such criteria as amount of schooling and ratings of intelligence by officers. In the development of this test, preliminary forms were administered, not only to military personnel, but also to a number of other groups, including college students, school children, and institutional feeble-minded persons. Later several other criteria were employed in such preliminary testing.

(7) Terman MC Nemar Test of Mental Ability. - This test replaced the carlier Terman Group Tests in 1940. Thus Terman MC Nemar Test is designed primarily for grades 7^+ to 11^+ although the authors report that it may also be used in grade 6 and in the first year of the college.

It is predominantly a measure of verbal comprehension, consisting of the following seven sub-tests: Information, Synonyms, Logical Selection, Classification, Analogies, Opposites and Best Answer.

(8) S.R.& Primary Mental Abilities, Psychometric Laboratory of University of Chicago. - It is a modification of Chicago P.M.A. tests for ages 11 to 17 which appeared in 1941. Chicago P.M.A. tests were adopted and modified by Science Research Associates. SRA primary mental abilities for ages 11^+ to 17^+

can be administered in forty to fifty minutes. It contains only one short test selected to measure each of the following five factors : Verbal - Meaning (V), Space (S), Reasoning (R), Number (N), and Word Fluency (W). No test of perceptual speed (P) has been incorporated in any of the forms for this age level. Tests of associative memory (M) which are included in the earlier and longer, Chicago PMA batteries were omitted from the SRA form because they required too much time to administer. Brevity and ease of administration appear to have been the major considerations in the preparation of SRA versions.

(9) Two numerical tests which had been included in the earlier form were eliminated from the revised form in order to make the test more homogeneous. The Terman MacNemasr Test has been prepared in two equivalent forms, C and D, each available in both hand-scored and machine-scorded editions. Each form requires approximately fifty minutes to administer and is described in the manual as being essentially a power test, the time limits allowed for each sub-test being adequate to enable most subjects to attain their maximum score.

(10) Group Mental Tests of Banaras University by Jalota. - This is a verbal group test for the use with college students prepared by Jalota of D.A.V. College, Lahore. It is in Hindi, Urdu and English. This test includes the following sub-tests:

(i) Similarities, (ii) Analogies, and (iii) Problems.

(11) Madras Non-verbal Tests for General Intelligence. - This test battery was prepared by Philip of Madras. Here in this test Otis self administering test has been adopted and developed. This test was standardized on about 2000 boys and girls and it is a suitable test for Indian conditions. The validity of this test is 0.96.

(12) Intelligence Tests Nos. 1-6. Bureau of Psychology, U.P. - This verbal group test of intelligence was prepared and standardized by Sohan Lal of Uttar Pradesh. This test was meant for the school-going students of U.P. for the age 11 plus. This test included the following sub-tests:

(i) Similarities
(ii) Analogies
(iii) Problems
(iv) Series

(13) Intelligence Tests by Dr. N. N. Shukla. - Dr. N.N. Shukla, in 1943, discovered that the scale adopted by Kamat could not be used for all Indian children speaking different languages. He conducted experiments on Gujarati speaking children. He concluded that it is essential to make certain changes in the scale before it could be used for Gujarati speaking people. Shukla translated Kamat's test and standardized it for Gujarati speaking children. This test is highly valid and reliable.

(14) Group Tests of Intelligence by Dr. K. G. Desai. - It is a battery of tests standardized in Gujarati by Dr. K. G. Desai. The battery includes Opposites, Disarranged Sentences, Proverbs, Logical Inferences, Number Series, Analogies, Similarities, Story Completion and many other test items.

(e) Some Common Forms. - The study of Foreign and Indian tests revealed similarity in the form of items such as 'Analogy', 'Opposites', etc. in many of the batteries of tests which differ in variety of ways. Most of the Indian tests are based on the pattern of tests originated in U.K W. Europe and United States of America. The study leads to the location of some very common forms of preparing the items. They are mentioned below :

(1) Similarities
(2) Opposites
(3) Synonyms and Autonyms
(4) Analogies
(5) Classification
(6) Disarranged Sentences
(7) Arithmetical Problems
(8) Number Sequences
(9) Geometrical Figures
(10) Imagining Completion
(11) Narrative Completion
(12) Memory Tests
(13) Proverbs
(14) Information

It was decided to try to prepare items of all the types listed above and then to choose the best out of them for trials.

(f) Writing the Items of Various Types. - The job of writing the items happens to be a complex one involving the following:

(a)Methods of selection

(b)Language of the testees and the problem on hand.

(c)The art of actual writing of the items

(d)Knowledge of guiding principles

(e)Final product.

There are two ways of collecting written items for a battery of tests, viz.,

(1) to translate test available and standardized in foreign countries, and

(2) to construct test independently for the specific area.

2. Translated items imply the following dr-awbacks:

(1) The environments of the two countries differ basically.

(2)The cusroms, social taboos and the like make the material of one country unsuitable for the other.

(3) Idioms and proverbs of one country be actually translated.

3. Translation would at times mean such a drastic change that the norms of the original tests would not be applicable[4].

[4] Menzel, E.B.: Suggestions for the Use of New Type Tests in India. Oxform University Press, Calcutta,1952.p.152

The following seven types of items were selected:

(a) Opposites

(b) Similarities

(c) Classification

(d) Analogies

(e) Problems

(f) Arithmetical Series

(g) Jumbled Sentences

4. The Art of Actual Writing. - There can be no set rules for writing the test items. Thorndike puts it beautifully, "Writing a good test item is an art. It is a little like writing a good sonnet or a little like baking a good cake. The operation is not quite so free and fanciful as writing a sonnet, it is not quite standardized as baking the cake.

It lies somewhere in between. So discussions of item writing is somewhere in between exhortation to the poet to go out and express himself and the precise receipes of a good cook-book",[5]

The test items should serve the purpose of testing. This should not be boring to pupils. Mc-Call suggests, "Tests should be enjoyable to both pupils and teachers."[6]

As mentioned above, no technical methods can be developed for preparing tests but still there are general principles which when observed contribute towards the framing of the better tests.

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[5] Thorndike, R.L. and Hagen : Measurement and Evaluation in psychology and Education". John Wiley and Sons, New York, 1955, p.50.

[6] Mc Call, W.A.:"Measurement". The Macmillan Co., New York,1949,p.43.

The following principles may be observed while writing the test items:

1) Pupils are likely to be interested in variety instead of the single type.

2) Items should not provide clues to the answers of the other items in a test.

3) Complex word, arrangement is apt to confuse the testers and hence this must be avoided.

4) The selection and planning of the test should be such that their administration becomes easy and simple.

Besides observing these principles, care should be taken that the directions to the pupils are clear, complete and concise.

Lindquist expresses his views regarding the number of items for try out[7]. " The number of items should be considerably larger than the number needed for the finished test".

The Problem for Kashmiri Pupils

Writing items for pupils of Kashmir has its own problems.

As Kashmiri is only a dilect and has no script of its own, any test meant for use with the children in Kashmir must necessarily be in Urdu, the official language of the State.

In all 280 items were written in seven of the types mentioned above. But after consulting the language experts etc. 237 items were retained, the rest were not

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7 Lindquist, E.F.: " Educational Measurement". American Council of Education, Washington, D.C. 1955 p.171

included in the test on account of their drawbacks.

The sources for writing the items were observations of the life and environment of the children, their social customs, their economic background on the one hand and school situation, curriculum and learning experience on the other.

Arrangement of Items

There are two methods of arranging the items.

(1) Discreet Method

(2) Omnibus Method

1. Discreet Method

In this method all the items of one type are arranged one after another. Each sub-test is to be completed in a given time allotted to it. Students have to stop writing when time allotted to a particular sub-test is over, whether they have completed all the items of the sub-test or not. The items are arranged according to their difficulty value.

Advantages of the Discreet Method

Instructions of each sub-test are given in the beginning. This is to enable the children to think desirably before they proceed to answer to questions. This also enables them to avoid confusing one test with the other.

The instructions given in the very beginning at once catch the attention of the students and they can easily follow them.

The sub-tests like story completion or verse completion which cannot be split up into fractions can be included in this method.

Disadvantages of the Discreet Method

1. As each sub-test is timed seperately the pupils are naturally disturbed.

2. The continuity of thinking is broken as the testees have to work according to the signals given by the administrator.

3. As the testees have insufficient time, most of them feel dissatisfied when the specified time interval ends.

4. The administration of the test becomes difficult and requires more trained staff to administer the test.

2. Omnibus Method

In this method, the items of all types are arranged according to the difficulty level. The easiest item occupies the first position and the hardest item occupies the last, irrespective of the types.

An over all time limit is given for the whole battery of tests.

Advantages of Omnibus Method

The testees are not disturbed at intervals in between the sub-tests as the time limit is fixed for whole battery.

The testees are able to answer items calmly as the time limit is fixed for the whole battery and hence the administration becomes easy.

Any lay man can administer the test because it does not require much skill.

Disadvantages of the Omnibus Method

1. As the items of the various sub-tests are combined, the examinees have to change their mental set up from one type to the other.

2. It works well with the advanced students as there are complications in instructions.

3. As there is an overall time limit, the pupils find it difficult to divide time between the questions.

4. One of the disadvantages of the Omnibus Method is that the battery here contains sometimes complex questions given at the end which are easily left out by students even though they know those questions but could not solve because of the limitations of time.

Looking to the pros and cons of the above two methods and keeping in view the quality and extent of education in Kashmir, the following modifications were made so as to remove the defects of the Discreet Method.

1. The form dividing the items into sub-tests according to form and nature of writing the items was fixed.

2. Instead of using specific time limit for each sub-test it was thought worthwhile to aim at fixing overall time for all the sub-tests together.

Abilities Measured

It can be seen from the above seven sub-tests that all sub-tests are purely verbal and measure ~~the~~ general ~~verbal~~ mental ability. And this was proper looking to the

psychological stage of the pupils, the environment under which they worked and the learning experiences they had in their own institutions.

Check Up of the Language of the Test Items

Thorndike states, "It is an axiom of writing that the author of statement is not best qualified to judge the clarity of the statement - he cannot appreciate the difficulties that others will have with his ideas".[8]

After constructing the test items the author sought co-operation of language experts and experienced persons in the field of education. All the items were checked separately by the above three persons and some of their suggestions were carried out so that pupils may not find difficulty in understanding the language of the test items. Thus the test items were made more welcome and practical. This added to the administrability of the test items. Out of 280 items only 237 were kept after the checking up of the items by the above mentioned experts.

Description of the Sub-tests

As mentioned previously, seven sub-tests were included in the battery.

To acquaint the students with the methods of answering sub-tests, illustrations were given in the beginning of the sub-tests. The following is the description of these sub-tests as included in the battery:

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[8] Thorndike, R.L. :"Personnel Selection" John Wiley and Sons, New York, 1954.p.64.

1. Opposites

In this sub-test a word was given in each line and from amongst the four suggested words which were written in the same row slightly separated, the subject has to underline the opposite of the first word.

There were forty items in the test. Among these there were nouns, adjectives, verbs and prepositions.

This sub-test is commonly seen in most of the group tests. This is in accordance with the principle of neogencies. Here the testee has to perceive the opposite relation. The four words from among which the opposite is to be underlined are very appropriately chosen. In the initial stages the child perceives the opposite relation with sufficient ease but at the later stage with decreasing frequency of rhyme opposites, the difficulty level is gradully raised to a high plain. Proper care has been taken in choosing proper words among which the correct opposites are to be worked out.

It demands intelligent apprehensions of the same. The test encourages analytical thinking. The testee finds two items related in a given way. They have to use great intelligence in finding out the proper opposites.

2. Similarities

In this sub-test, three words showing some type of similarity are given. In the same line five other words are given. Pupils have to find out and underline one word just similar to three words from five suggested words. This is also a test of preceiving relation.

wherein 'G' factor is tackled. This test turns out to be among the best of the battery. The similarities Tests have several merits. It is easy to give and appears to have an interest appeal for the average pupils. In this sub-test forty items with an example are included. This type of test is also included in most of the group tests.

3. Classification

It involves the testee to search the work which is not relevant to the words given on the line. Here also the pupil has to strain his intelligence to the maximum.

It involves the testee to search the work which is not relevant to the words given on the line. In other words it is a very poignant test for intelligence. The ability which comes to play for the selection of such a word is highly saturated with 'C' factor. This test includes thirty items.

4. Analogies

In Analogy Type Test first words in each line are related to each other in some way. The same relation is to be observed between the two words to be found out from the four words given on the right hand side. Forty items are included in this test with an example. This test is very pupular and is found in almost all group tests of intelligence.

The ability which comes into play for finding out the relations of such words is also highly saturated with 'G' factor.

5. Problems

In this sub-test, the great mental power is needed on the part of the testee. It is a valid test for measuring the intelligence of a pupil. Thirteen such items with an example were selected in this test. This test calls forth a great intelligent activity on the part of the testee. It is, therefore, a very valid item for measuring the intelligence of an individual pupil.

6. Number Series

This is in fact the main test which calls forth abstract thinking. In this test numerical relation is to be seen between the test items and the series is to be continued. This test demands the interplay of intelligence for perceiving the orderly setting.

The main instrument of reasoning and communication in ordinary life are language and number. One of the most important of the number tests is a Number Series.

In this sub-test, arithmetic number are arranged in the form of series. Brackets are kept blank in which pupils have to write the required numbers, studying the arrangement of series. There are twenty-seven items in this sub-test. Here the child has to give one additional number which suits in the series mathematically.

By this test, it is possible to gauge numerical ability, an ability next to the verbal one. Thus by knowing

something about both the numerical and verbal abilities, we can make comparatively accurate measurement of the ability of the student.

7. Jumbled Sentences

This test is partly of general information type. In this test words making a test sentence are disarranged in each item and the testee has to find the proper place of the words in the sentence. This test also included thirty items. In fact this sub-test is saturated with 'G' factor.

Summary

In this chapter systematic procedure of critical evaluation of the available tests in the foreign countries as well as Indian was undertaken and the outcomes of the study thereof were applied to the situation in hand. This facilitated the task of laying down the procedure for writing items, their types and so on. To be more practical, help of the experts and language specialists was sought in order to check the language and the like. Finally, the items were classified, selected and arranged for actual try-outs.

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