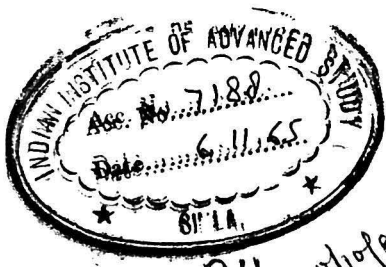
INDIAN INSTITUTE OF
ADVANCED STUDY
SIMLA

PROGRESSIVE MATRICES TEST (1956-Version)
APPLIED TO A GROUP OF
SECONDARY SCHOOL GOING CHILDREN
IN
GUJARAT

D. B. Desai

FACULTY OF EDUCATION AND PSYCHOLOGY
Maharaja Sayajirao University of Baroda
1960



Printed by Ramanlal J. Patel, Manager, The Maharaja Sayajirao University of Baroda Press (Sadhana Press), near Palace Gate, Palace Road, Baroda and published by Professor T. K. N. Menon, for the Faculty of Education & Psychology, Baroda.

FOREWORD

Mental tests have become today the indispensable and inseparable allies of education. They are used for a variety of purposes in all spheres of education and as a result they have not only reduced wastage in education, but also added considerably to its strength and efficacy. While these tests are used in the West as a matter of regular procedure in school teaching, school organisation, guidance and counselling, teachers and educational administrators in India are handicapped because of the paucity of mental tests which are standardised in the Indian situation and context. It is gratifying that during this decade, we have several attempts made by Teachers' Colleges and University Departments of Education to construct and standardise mental tests. There have been similar attempts to select proper tests that are in use in the West and find out the norms after applying them to adequate samples in India and making the necessary statistical analysis. The study presented here belongs to the latter category.

In the study, Mr. D. B. Desai was concerned with "The 1956–Version of Progressive Matrices Test"—a non verbal group test of intelligence prepared by Mr. J. C. Raven, Director of Educational Research, Dumfries. Besides studying its validity and reliability the author has found out the different types of norms on a proportionately large sample of secondary school—going children of Gujarat. There can be no doubt that these norms will be of great use to secondary schools in the area. An interesting study of item-analysis based on internal consistency and on external criteria has also been undertaken by the author. This will be welcome to research-workers in the field, who want to pursue further investigations into the subject.

T.K.N. MENON.

CONTENTS

CHAPTER 1

INTRODUCTION

Education unlocks the latent energies of children. We know that no two children are alike. They differ in their abilities. Education must be based on the needs of the children. Moreover, the achievements of the children depend not only on the environment but also on innate abilities. Hence there is a need to know the intelligence of a child and for this we must take the help of psychological tests.

The development of psychological tests is in its infancy in India, but looking to the interest evinced in the subject by our psychologists as well as by the lay public, it can be said that it is assured of a glorious future.

It has been accepted that " each individual is a unique adventure of life ", and that " the function of education is the guidance of this adventure to the realisation of the potentialities of each individual in the face of the actual world of men and things. It aims at the development of the individual, the discovery, training and utilisation of his special talents ".

The high ideal for the educational system envisaged by our great thinkers is alluring, but when we come to its application, we find ourselves faced with the colossal task of spreading education to the masses. It has become practically impossible to give the teacher the freedom and peace of mind to study all the pupils of his class to his entire satisfaction. It is a difficult job to discover the true strength of pupils' abilities and their general dispositions.

In the Western countries where the blending of practical problem of mass education and theoretical aim of the development of an individual is happily attained, the knowledge of the individual pupil is acquired through objective psychological tests which are properly standardized.

The original tests of Western countries cannot be applied to Indian children because cultural, educational, social and economic factors of those countries differ from those in India. Accordingly, before any adaptation is feasible, considerable research should be done to determine whether the test is valid for adaptation. Without such care one is likely to construct a measurement scale leading to incomplete and false conclusions. So we cannot rely upon the results of the original tests. Tests suitable to different aspects of Indian life may be adapted and the standards obtained therefrom may be considered reliable and valid. The tests must be standardised so as to make them suit Indian subjects. Measures of internal consistency, besides validity and reliability of the tests, should be determined on a large sample.

The norms should also be determined on sufficiently large samples of the various strata of the Indian population to make the test standard.

The lack of such tests constructed for Indian situation and properly standardized with reference to Indian children, is glaring. It is because of this that the teacher has to face innumerable problems in fulfilling his duties conscientiously.

In the sphere of education, a secondary school teacher comes across hundreds of subnormals being pushed through college every year, and he also sees a good number of gifted children being forced to spend their time and talents in activities with which they are thoroughly unfamiliar. Such situations arise because of ignorance about pupils, on the part of parents as well as teachers.

Many parents set a high level of aspiration for their children or encourage them to develop one which may be far above their level of accomplishment. Such children might get into many difficulties, perhaps drift into delinquency unless treated sympathetically by parents, teachers and others with due regards to their intelligence. For this purpose the first thing the teacher is required to know is the pupil's intelligence. Unless there

are some objective measurements to help the teacher in judging pupil's abilities, it is not possible to reorient the educational scheme to the desired purpose.

Thus the first requisite for an educational progress is to acquire the detailed knowledge about each and every pupil. In advanced countries, the teacher gets this judgments by administering mental tests, especially the tests of intelligence.

It naturally follows that our first need in the field of education is to have objective measurement of pupils' abilities, especially of intelligence. Hence the work of studying intelligence tests and the possibility of applying Progressive Matrices Test to Indian situation is taken up in this investigation.

CHAPTER 2

THE PRESENT INVESTIGATION

The Progressive Matrices Tests :

As there have been difference of opinions which are misleading with regard to the purpose and nature of the test, it is advisable to be clear about the same. Raven described it as providing a non-verbal series of tests suitable for measuring intelligence.

He clarifies the meaning of his Progressive Matrices Test. About his test, he writes,

> " It is often useful to describe the scale as a test of observation and clear thinking. By itself it is not a test of ' general intelligence ' and it always is a mistake to describe it as such. Each problem in the scale is really the ' mother ' or ' source ' of a system of thought—hence the name ' Progressive Matrices'. The scale has a re-test validity varying, with age, from 0.83 to 0.93. It correlates 0.86 with the Terman-Merrill Scale and has been found to have a ' g ' saturation of 0.82 ".[1]

According to Gertrude Keir,

> " It originally meant to be a test of ' Intelligence ' which is not dependent of ' verbal facility or educational or cultural background '.

According to her,

> " The general nature may be described as consisting of a number of visual problems, each having the form of a two-way serial Analogies Test ".[2]

As it was stated in the original description in C. Burt's book, " Experimental Test of Higher Mental Processes ", it is a test

1. J. C. Raven, " Guide to Using Progressive Matrices " P. 1, H. K. Lewis & Co., Ltd., London, Revised Order 1956.
2. British Journal of Psychology : " The Progressive Matrices as applied to School Children " Statistical Section. P. 140.

of moderate complexity, involving the perception, implicit or of moderate complexity, involving the perception, implicit or explicit of a relation and the reconstruction of analogies by so-called relative suggestion.[3]

Advantages of this Test :

On the basis of the concept of education advanced by Spearman, Raven argues, " Perceptual tests....may appear useless artistic studies or obscure mathematical problems but upon investigation success insolving them is found to depend upon the ability for logical thought which is the essential factor in all intelligent conduct. Progressive Matrices is a series of such tests designed to measure the accuracy of education.[4]

As Rimoldi writes about the test,

" The loadings of the different sets in the different factors related to perception, construction of wholes, memory, relations of right and left, speed, of perception and a non-identificial factor, seem to play a considerable part in the actual solution of items ".[5]

Rimoldi suggests a very wide application of this test. He writes,

" The comparison of the values obtained by the administration of Raven's ' Progressive Matrices ' in different population, different countries and different testing situations, shows that there is a strong similarity between these different studies. We recommend its use when the psychologist is interested in employing a non-verbal test, well graded in difficulty, with good descriminative value and applicable to a wide age range ".[6]

---

3. *Ibid*, P. 140.
4. J. C. Raven, " Matrix Tests " P. 12, Mental Health I (1940).
5. H. J. A. Rimoldi, Article—" A Note on Raven's Progressive Matrices ", P. 347. Educational and Psychological Measurement, Part I, Vol. VIII, No. 3, 1948 (Autum).
6. *Ibid*, P. 351.

Another advantage is cited by G. Keir. " It is almost self-explanatory like the verbal analogies ", says G. Keir. " The matrices may be either graded (increasing in difficulty) or ungraded (of approximately equal difficulties)". Because of the progressive self instruction, it is responsible for high correlation of such test with intelligence. Previously it was found out, some of the patterns could still be made to lend themselves more readily to the analytic or explicit type of approach and others to the impressionistic or intuitive type of approach. The earliest versions of the test, therefore, included two main series of item on analytic test, and a synthesis almost equally balanced.[7]

The Description of the Test :

The scale consists of 60 problems divided into five sets of twelve each. In each set the first problem is self evident.

> " Each page of the booklet contains in the upper part a pattern in which a part is missing. At the bottom of the page several numbered pieces of the same size and form as that of the missing part are arranged in two rows. Of all these, only one completes the pattern. "[8]

The problems which follow become progressively more difficult. The order of the test provides the standard training in the method of working. The five sets provide five opportunities for grasping the method and five progressive assessments of person's capacity for intellectual activity.

> " To ensure sustained interest and freedom from fatigue, the figures in each problem are boldly presented accurately drawn and pleasing to look at ".[9]

The scale is intended to cover the whole range of intellectual development from the time a child is able to grasp the idea of finding a missing piece to complete a pattern and to be sufficiently

7. Keir Gertrude, " The Progressive Matrices as applied to School Children ", British Journal of Psychology, Statistical Section, Vol. II, Part 3.
8. Rimoldi, *Op. cit.* P. 347.
9. Raven, *Op. cit.* P. 1.

long to assess a person's maximum capacity to form comparisons and reasons by analogy without being unduly exhausting or unwieldy. The scores obtained by adults tend to cluster in the upper half of the scale, but there are enough difficult problems to differentiate satisfactorily between them.

From this description of the test, it becomes obvious that it does not depend to any large extent upon the education or amount of information of the subjects, that " it can be easily applied to foreigners and to normal or physically or mentally defective children ".[10]

All the drawings are clearly presented in black and white. The instructions are short and simple, and the subject is asked to find out which of the pieces completes the larger pattern. He is asked to work all of the problems without hurrying, at his own speed. Generally, pupils are observed to finish it within an hour.

Uses of the Progressive Matrices Test:

Diagnostic Use: " The matrices test can provide a valid means of assessing a person's present capacity for clear thinking and acurate intellectual work. This indicates the rate at which the students may be expected to progress ".[11]

Mental Development : Mental Development in childhood appears to take of distinct, rather rapid, intellectual maturations, more like salmon leaps in the stream of life than the equally arranged rungs on a ladder. Convenient as the latter hypothesis may be for the purpose of quantitative assessment and mathematical computation, it does not seem to correspond to any psychological reality in the life of the child. It is therefore absurd to expect the results to conform at closely to this hypothesis[12] and misleading to construct a test or to weigh the results obtained on the basis of any a-priori assumption of this kind.

---

10. J. C. Raven and A. White, " Experiments on Physically and Mentally Defective Children with Perceptual Tests ", P. 40. British Journal of Medical Psychology, XVIII, 1939.
11. Raven, *Op. cit.*, P. 4.
12. Keir Gertrude, " The Progressive Matrices as applied to School Children ", British Journal of Psychology, Statistical Section, Vol. II, Part 3, 1949.

Following upon earlier mental development between the ages of 8 and 11 years, there appears to be an almost complete transformation in a child's process of reasoning. Before it has occurred, a child can comprehend little more than the kind of problem presented in sets A and B of the standard matrices scale. His vocabulary tends to be limited, and his education largely depends on practical work and visual aids. Afterwards, a child is able not only to form comparisons and reason by analogy but also to adopt this way of thinking as a consistent method of reasoning. He progresses without difficulty, from the problems constituting sets A and B of the Matrices Test to the problems constituting sets C, and D and E.

He is able to grasp the meanings of abstract words. He profits more from available educational opportunities and there is a marked steady increase in his vocabulary test score.

This apparently decisive stage in intellectual maturation distinguishes the intellectually immature person from the person of normal, or more than normal intellectual ability. It also appears to be one of the earliest decline in later life and the one apt to be seriously impaired as the result of organic defusion. Racial studies indicate that this is partly a native endowment of the individual, and partly the result of environmental influence and cultural opportunities, at least to the extent that in the absence of stimulation; the consistent development of logical reasoning tends to remain latent, or to develop somewhat in later life. It has also been found that a person's social relations affect the use he makes of his opportunities, and the mental abilities as a result he tends to develop.

Intellectual Capacity and Efficiency :

A person's maximum capacity for clear thinking has been found to vary with health and to improve with practice less than his speed of accurate intellectual work. For anthropological, genetic and clinical studies, an untimed ' capacity ' test is therefore more useful than a test in which a person is working against time. For vocational guidance and occupational selection, on

the other hand, a ' speed ' or ' efficiency ' test is sometimes more appropriate. For the former, therefore, Progressive Matrices is the more useful. For the latter, and specially for the guidance for selection of people wishing to pursue higher technical courses of training, Progressive Matrices sets I and II are more discriminating and also more useful for the study of mental fatigue and its effects upon quick and accurate judgment. Before the age of eleven a child's ability to form comparison and reason by analogy is often too recent and intellectual achievement for it to be exercised with a consistent degree of efficiency. In all cases of this kind, Progressive Matrices used as untimed test, is the more appropriate form to employ.

The Present Investigation :

The concise opinion of all the investigators leads to the conclusion that the Progressive Matrices Test is valid, reliable and objective. And it is likely to be affected least by ' culture influence '. But then, before accepting the norms found out by other investigators in other countries and cultures, it is extremely essential to study and find out how it works with the Indian children, with different cultural background. Hence it was decided to take up a critical study of Progressive Matrices Test and to find out for practical purposes its suitability to the secondary school going children of Gujarat for practical purposes. The following tentative plan was chalked out and followed in the present study.

(1) The Problem and Plan :

Progressive Matrices Test as applied to a Group of Secondary School Going Children in Gujarat.

1. To select a proper *sample* from secondary school going children.
2. To study its *validity* and *reliability.*
3. To find out the *norms* of different groups, age-wise, grade-wise and area-wise.
4. To find out the discrimination and difficulty value of *items.*

The work of finding out possibility of the applicability of Progressive Matrices Test (1956 Revised Order) for secondary school going children of Gujarat, is the first of its kind in Gujarat.

(2) The Aim of Investigation :

Our chief aim is to study the application of this test to the secondary school going children in Gujarat. How far the test can be applied to secondary school going children (between age groups 13+ 14+ 15+ 16+ 17+)? As a result of this study the following questions can be answered :

1. What are the *norms* for the age groups (of 13+ 14+ 15+ 16+ 17+) ?
2. What are the grade-wise norms (for Std. VII, VIII, IX, X)?
3. How far the norm of *Rural and Urban* population differ ?
4. What is the relation of *ages* with *grades* ?
5. What is the discriminating value of items on the basis of assumed external criteria and on the basis of internal consistency ?
6. How far the test can be useful to the schools in Gujarat ?

B : Another aim of the present study has been to discover the extent to which each item of the Progressive Matrices Test discriminates and to ascertain the difficulty level of each item of the test and on the basis of this to suggest. The difficulty level of each item will enable a better arrangement of the items ranging from the easiest to the most difficult. At the end of the enquiry, the following questions might be answered :

(1) Which items do not discriminate well ?
(2) Which items have good power of discrimination ?
(3) How many items are very easy ?
(4) How many items are very difficult ?
(5) How many items are of medium difficulty ?
(6) Is the arrangement of the items suitable to the secondary school going children of Gujarat ?
(7) Will all the items have a proper validity with reference to the present sample ?

Summary :

As Progressive Matrices Test (1956 Version)—a non-verbal group test of Intelligence—is found useful by many psychologists, this test was taken for study, in the present investigation; with a view :

(a) to find out its reliability, validity and applicability;

(b) to find out the age-wise, area-wise, grade-wise norms of the secondary school going children in Gujarat;

(c) to study the item analysis on the basis of internal consistency and external criteria.

CHAPTER 3

SAMPLE AND ADMINISTRATION OF THE TEST

The Sample :

The following sample was decided upon for the present investigation:

1. The aim of the present investigator is to study Progressive Matrices Test, for use in the Secondary Schools. Therefore the sample is limited to the age-groups 13+ 14+ 15+ 16+ 17+ the age limit of secondary school population.

2. The sample was limited to the area of Gujarat. It includes nearly all the districts of Gujarat. The number of schools selected is on the basis of percentage calculation.

It can be easily seen from the table (table 1 page 13) of classification of sample that :

The " Size " of the sample is quite proper to the size advocated by Garrett, Lindquist and others.

The Sample can be said to be " representative " if we take into consideration the area covered, *i.e.* rural, urban and town population. The sample includes both the sexes, *i.e.* boys and girls. The sample includes different grades in the same age group, *i.e.* students of 13 years may be studying in standard VII, VIII, IX or X. This made it possible to calculate the age-at-grade scores.

The Administration of the Test :

The Progressive Matrices Test was administered to the pupils included in the sample as shown in the tables of sampling. The following points, as given by J. C. Raven in " Guide to Using Progressive Matrices ", were taken into consideration while administering the test.

TABLE 1

The Sample Selected in the Present Test

Type/Age Group		13+	14+	15+	16+	17+	Total
Sexwise	Boys	265	283	295	210	324	1,377
	Girls	105	87	75	160	46	473
Total		370	370	370	370	370	1,850
Areawise	Urban	325	337	318	312	297	1,589
	Rural	45	33	52	58	73	261
Total		370	370	370	370	370	1,850
Gradewise	VII	195	88	82	43	—	408
	VIII	142	198	123	148	54	665
	IX	33	67	107	120	90	417
	X	—	17	58	59	226	360
Total		370	370	370	370	370	1,850
Districtwise	Surat	99	101	167	71	143	581
	Broach	32	20	39	28	24	143
	Ahmedabad	160	100	107	88	71	526
	Mehsana	10	54	37	40	44	185
	Baroda	42	82	10	126	74	334
	Kaira	27	13	10	17	14	81
Total		370	370	370	370	370	1,850

(1) *Materials ;*

A set of test books is required. These can be used repeatedly. Each person requires a record form and a pencil. The sample of record form is given in the Appendix.

(2) *Accommodation :*

The test was given under normal class conditions. The students to be tested were seated comfortably on the benches with room for books and record forms and sufficiently apart to prevent copying.

For the facility of accommodation, this procedure was followed. The class to be tested, was taken to the central hall of the school or to a large class with a facility for seats. Space was left so that the supervisors can pass easily between pupils without disturbing them.

(3) *Procedure :*

Pencils and record forms were distributed. The pupils to be tested were asked to fill in particulars about themselves on the record form. When this had been done, the test books were given out. They were asked not to open the books until everyone was ready; the investigator said, " Open your book to the first page. It is like this ". He opened a book for the group to see.

" At the top, it says, Set A and you have a column A here, on your scoring form. This is A.1. You see what it is. The upper part is a pattern with a bit missing. Each of these bits below (he pointed to each in turn) is the right shape to fit the space, but they do not all complete the pattern. No 1 (he pointed to the bit and then to the pattern) is quite the wrong pattern. Numbers 2 and 3 are wrong. They fit the space, but they are not the right pattern. What about number 6 ? It is the right pattern, (he illustrated that the pattern is the same as the pattern above) but it does not go all over. Put your finger on the one that is quite right ".

The investigator notices if this is done correctly. If necessary, he gives further explanation and then says, " Yes, number

4 is the right one. So the answer to A.1 is 4. Write 4 here against number 1 in column A on your scoring form. Do not turn over yet ".

The investigator waits for every one to finish and continues, " On every page of your book there is a pattern with a bit missing. You have to decide each time which of the bits below is the right one to complete the pattern above. When you have found the right bit, you write the number of it down on your scoring form, against the number of the pattern. They are simple at the beginning and get harder as you go on. There is no catch. If you pay attention to the way the easy ones go, you will find the latter ones less difficult.

Try in each turn, from the beginning right to the end of the book. Work at your own pace. Do not miss any out. Do not turn back. See how many can get right. You can have as much time as you like. Trun over and do the next one. ".

(4) *Supervision :*

For supervision, Raven gives these instructions. Mistakes occur in filling up the record form. supervisors should see that each person has entered correctly on his form his own solutions to the first five problems. Once a person has grasped the nature of the initial problems, supervisors give no further assistance in the method of reasoning but see that each person records his own choices correctly at the right place in the record form.

Pupils frequently omit a problem. Fifteen minutes after the commencement of the test, supervisors see that each person is still recording his choices against the correct numbers on his choices against the correct numbers on his record form.

After about half an hour pupils are asked to indicate when they have finished, when they do, supervisors see that the record form has been filled up correctly and that every problem has been attempted. As people finish they are asked to give in their books and go out, or to proceed to the next part if there is one.

For the purpose of timing, the test is taken to begin when the person in charge says, " Turn over and do the next one yourself ". The time of ending the test is noted as scoring forms are handed in.

(5) *Scoring ;*

After the test has been administered, every answer sheet was examined and scoring was done. The score was noted against the name of the pupil. Other details were also noted, *e.g.* the place, the school, the caste, the vocation of the father, birth-date, etc.

Summary ;

The Criteria for adequate, proportionate and representative sampling were studied and a sample was decided to administer the Progressive Matrices Test (1956 Version). The test was administered on the sample with the technique of administration of the test given by Shri J. C. Raven in his " Guide and Using Progressive Matrices ".

CHAPTER 4

ANALYSIS OF THE DATA

After collecting the data, analysis of the data is necessary. Without the analysis of the data, collection of data is meaningless. The preliminary analysis of the data enables the investigator to further statistical meaningful interpretations.

Score :

On the Progressive Matrices Test the maximum possible score is 60 and the minimum is 0.

In the present group the highest score obtained by the pupils is 54 and the lowest score is 6.

Mean Score, Standard Deviation and Critical Ratio
(Age-wise, Area-wise and Grade-wise)

Age :

It is accepted that an intelligence test must give higher score in the increase in age upto a particular point.

The Mean Scores and S.D. of the different age groups are given below :

TABLE 2

The Mean Score and Standard Deviation Age-wise

Age Group	N	Mean	S. D.
13+	370	26.92	9.90
14+	370	29.30	11.20
15+	370	31.31	10.10
16+	370	33.04	10.85
17+	370	35.35	10.60

TABLE 3

Critical Ratio of the Mean of Different Age Groups

Age Groups	14+	15+	16+	17+	Remarks
13+	3.07				Significant beyond doubt
14+		2.56			Significant
15+			2.25		Significant
16+				3.55	Highly Significant

TABLE 4

Mean and Standard Deviation Age-at-Grade-wise

Grade	VII		VIII		IX		X	
Age	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
13+	25.20	8.15	28.93	10.50	32.39	10.20	—	—
14+	26.64	9.45	29.39	9.91	30.91	8.98	34.17	10.10
15+	25.30	6.78	28.08	9.60	29.96	10.17	36.87	9.25
16+	25.55	7.95	29.75	10.30	33.96	10.47	37.49	9.13
17+	—	—	24.75	9.16	30.44	12.40	35.81	17.30

From the above table the following conclusions can be drawn.

(1) The lower the age and higher the grade, intelligence score increases.

(2) The higher the age and lower the grade, intelligence score decreases.

(3) The normal grade for the pupil of age group 13 is VII.
The normal grade for the pupil of age group 14 is VIII.
The normal grade for the pupil of age group 15 is IX.
The normal grade for the pupil of age group 16 is X.

TABLE 5

Critical Ratio of the Mean of Different Grades

Grades	VIII	IX	X	Remarks
VII	1.27			Not Significant
VIII		5.75		Highly Significant
IX			4.15	Highly Significant

Significance of Mean :

From the table of critical ratio we can see that there is a significant difference between the Mean of each successive age group. This leads to the conclusion with much confidence that the present Mean Score for each age group found out can be used with greater confidence and is applicable to the secondary school going children in Gujarat.

Area :

In order to see area-wise difference in the Mean Score, Means and S. D. were calculated separately for urban and rural pupils, as shown in the following table. The difference between the score of urban pupils and rural pupils as represented by their Mean is highly significant.

TABLE 6

Mean and Standard Deviation Rural and Urban Pupils
(Agewise)

Age Group	Area	Urban	Rural	
	Mean	S. D.	Mean	S. D.
13+	26.63	9.60	21.80	7.82
14+	29.96	9.71	22.55	9.81
15+	31.86	10.37	26.45	10.70
16+	34.06	9.20	29.15	10.16
17+	35.95	10.77	32.11	8.45

Difference in the Mean between these age groups were tested for significance by critical ratio. The above table shows the critical ratio obtained comparing the Means of areawise groups.

TABLE 7

Critical Ratio of different Age Groups of Urban Population

Age Groups	14+	15+	16+	17+	Remarks
13+	4.44				Highly Significant
14+		2.42			Significant
15+			3.54		Significant beyond doubt
16+				2.33	Significant

TABLE 8

Critical Ratio of Different Age Groups of Rural Population

Age Groups	14+	15+	16+	17+	Remarks
13+	0.36				Not Significant
14+		2.26			Significant
15+			1.35		Not Significant
16+				1.78	Not Significant

From the table we can see that there is a significant difference between the Mean of urban and rural areas. Between the age 13 and 14 in rural area, the difference is not significant.

Grade :

The Mean and S. D. of various grades are shown in the table below to find out whether educational level has anything to do with the performance on the Progressive Matrices Test. The Means of the various standards can be examined from the table. There seems to be some increase with higher educational level.

TABLE 9

Gradewise Mean Standard Deviation and Critical Ratio

Grade	No. of Pupils	Mean Score	S. D.	Critical Ratio	Remarks
VII	408	25.68	8.25		
				1.27	Not Significant
VIII	665	28.62	10.30		
				5.75	Highly Significant
IX	417	32.35	10.59		
				4.15	Highly Significant
X	360	35.47	10.36		
	1,850				

The Specificity of Norms :

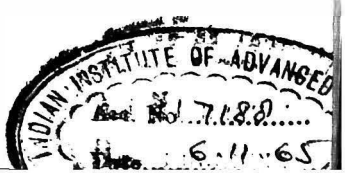
Any norm, however expressed, is restricted to the particular normative population in which norms are established. Test norms are in no sense absolute, universal or permanent. They merely represent the test performance of the subjects constituting the standardization sample, so in the development and application of test norms, considerable attention should be given to the standardization sample. It should be large enough to provide stable values.

Normative population should be clearly defined. The characteristics of such population should be taken into consideration in interpreting test scores. For many purposes, moreover, specific norms, based on more narrowly defined normative populations are more useful than general norms.*

Applicability of Norms :

Theoretically norms are applicable only to samples and individuals; that correspond reasonably closely to the standardisation sample. In actual practice strict comparability between " application group " and the original " Norm group "

* Anastasi Anne : ' Psychological Testing ' Chapter 4. The Macmillan Co., New York, 1956.



is usually questionable or difficult to ascertain—partly because the standardization sample is seldom sufficiently well described. When specific lack of comparability is known, this may be taken subjectively into account in employing the norms or interpreting the pupils' scores.

" The need for interpreting or modifying the norms is likely to be of special importance, since the methods, curriculum, selective factors are likely to change with time ".

Whatever is said and done it is generally recognised that valid norms are essential for dependable level of interpretation of individual and group measures. The application of norms is apparent in such statements as, " Rama is above average ", " Saroj is at the 75th percentile ".

> " In fact our very language and thinking involving and reauiring such terms as ' little ', ' much ', ' typical ' etc. imply the recognition of norms. It is obvious then that norms are of basic importance ".*

Validity and Reliability :

The investigator studied the validity of the present test with three external criteria. Reliability is studied by Split-Half method. The table below shows the result.

Progressive Matrices Test :

	Validity	Reliability (by Split-Half Method)	.89
Kohs' Block Design Test	.90		
Test of Faculty of Education and Psychology used by Shri T. P. Lele	.53		
Examination Marks	.30		

This shows that Progressive Matrices Test is valid and reliable.

---

* Monroe : ' Encyclopaedia of Educational Research '—p. 800.

TABLE 10

Norms

Age/Type	Area Norms		Age-at-Grade Norms				Grade Norms	
Age Norms	Urban	Rural	VII	VIII	IX	X	Stds.	Norms
13+ 27	27	22	25	28	32	—	VII	25
14+ 29	30	23	27	29	31	34	VIII	29
15+ 31	32	26	25	28	30	36	IX	32
16+ 33	34	29	25	29	33	37	X	35
17+ 35	36	32	—	24	31	36		

TABLE 11

Percentile Scores

P	13+	14+	15+	16+	17+
P_{10}	12.35	15.65	16.96	16.41	21.78
P_{20}	18.14	21.00	22.67	23.20	26.78
P_{30}	20.79	24.24	26.27	27.91	29.73
P_{40}	24.4	27.35	28.2	31.63	32.59
P_{50}	27.78	30.28	33.05	34.58	35.4
P_{60}	30.91	33.12	35.42	37.67	38.34
P_{70}	33.12	35.92	38.06	40.91	41.46
P_{80}	35.30	38.80	40.77	44.00	44.30
P_{90}	39.68	42.62	44.70	47.85	50.86

Summary :

The investigator calculated all the types of norms *e.g.* agewise norms, areawise norms, gradewise norms, age-at-grade norms. The norms were tested for significance by critical ratio. The table is given in the previous chapter. This leads us to the following conclusion :

(1) The Critical Ratio of Agewise norms is significant beyond doubt and hence the norms are applicable to Gujarat.

(2) The Critical Ratio of the Means of different grades suggests that the norms of Grades VIII and IX, and IX and X are highly significant. The difference between the norms of the grades VII and VIII is not significant.

(3) The Critical Ratio of urban population is highly significant. Hence this test can be applied with confidence, to the urban pupils.

(4) The Critical Ratio of rural pupils is not significant.

(5) The Validity of the test was studied with Kohs' Block Design Test, with the Test of Faculty of Education and Psychology used by Shri Lele and with examination marks. The Reliability of the present test was studied by split-half method. The test was found to be Valid and Reliable.

CHAPTER 5

ITEM-ANALYSIS
(A further study)

Both the reliability and the validity of a test depend ultimately upon the characteristics of the items which make up the test. It follows that any test can be improved through the selection, substituiton, or revision of items. With the growing refinement of test construction, Item Ananysis has received incerasing attention.

" Item analysis is concerned primarily with two characteristics of items, *viz.* difficulty value and discriminative value. The effectiveness of a test can be increased by the selection of items of suitable difficulty. Both the types of subjects and the purpose for which the test is designed must be considered in determining the over all difficulty to be covered by the items. Discriminative value or item validity concerns the degree to which performance on an item correctly differentiates between indidividual differences in the characteristics which the test is designed to measure ".*

Purposes :

Item analysis serves many important purpose in the technique of test construction :

(1) It supplies information concerning the item as a whole :
- (a) it gives a measure of the correlation between the test items and a criterion of each item.
- (b) it supplies a measure of the difficulty of each item.

(2) It is from item analysis data that we got information concerning the individual choices or alternatives offered by the item. This includes selecting a given alternative in the item as an answer.

---

* Anne Anastasi : *Op. cit.* P. 162.

Burt was the first to introduce the idea of item analysis in the test construction and he carried out the item analysis in details on the original Binet Simon Test in 1921.*

By this method the value of each separate item in addition to the value of the test taken as a whole can be systematically investigated,

The phrase 'Item Analysis' is used in two different senses. The original meaning covered an intensive field including item validity, item difficulty, ease of marking details about ambiguity of problems or of answers etc.

But recently the term is used in a narrower sense as a convenient term to denote statistical method for determining the item validity. Numerous methods have been put forward to determine the item validity.

In the present study the following methods have been used.

Item analysis is concerned with two characteristics of items, *viz.* difficulty value and discriminative value. The effectiveness of a test can be increased by the selection of items of suitable difficulty. Discriminating value, or item validity, concerns the degree to which performance on an item correctly differentiates between individuals who differ in the criterion. In other words it is the degree to which an item detects individual differences in the characteristics which the test is designed to measure.

Measuring Item Difficulty :

There are several reasons for determining the difficulty of an item. Items which are passed or failed by all subjects have no discriminating value, and should, therefore, be avoided. A few very easy items may, however, be inserted at the beginning of a test in order to arouse confidence and reassure the subject.

---

* Cyril Burt : " Mental and Scholastic Tests ", P. 225, Staples Press, London, 1921.

In the present study the investigator has used three techniques for *measuring item validity*—Biserial Correlation, Lawshe's Nomograph and Coefficient of Colligation.

The Investigator has conducted item analysis on extreme groups. These extreme groups are chosen on the basis of criterion scores.

Item Analysis on the Basis of External Criteria :

An Item analysis, the criterion may be either an independent, external measure or total score on the test. Correlation with external criterion may be properly designated as indices of " Item Validity ", while correlations with total score may be more precisely described as indices of " internal consistency ".

Each item in this study was analysed in terms of :

(1) External Validity, the criterion being examination marks,

(2) Internal Consistency, the criterion being total score.

" One must be aware of the thing that Item Validity and internal consistancy should not be regarded as interchangeable. Correlation with total test score is not a substitute for correlation with an external criteria, but they give different sort of information regarding the item. "*

Now let us see, which items will be considered to be valid, if we take examination marks as external criteria.

* Anne Anastasi—*Op. cit.* P. 164.

TABLE 12

The Frequency of Methods of Finding Validity of Items on the Basis of External Criteria

Sr. No.	Age 17+	Age 16+	Age 15+	Age 14+	Age 13+
1	A6 (2)	A3 (3)	A4 (2)	B2 (2)	B10 (3)
2	A7 (2)	A4 (3)	B8 (3)	B5 (2)	C9 (2)
3	A8 (2)	A6 (2)	B9 (2)	B9 (2)	C11 (2)
4	A10 (3)	A9 (2)	C1 (3)	C1 (2)	D9 (2)
					Total 4
5	A11 (3)	A10 (3)	C2 (3)	C3 (3)	
6	B3 (2)	A11 (3)	C3 (2)	C6 (2)	
7	B5 (3)	B7 (2)	C4 (3)		
8	B6 (2)	B9 (2)	C6 (2)	D1 (3)	
9	B7 (3)	C3 (3)	C8 (2)	D2 (2)	
10	B8 (3)	C4 (3)	C9 (3)		
11	B9 (3)	C5 (3)	C11 (3)		
12	B10 (3)	C6 (2)	D3 (2)	D3 (2)	
13	B11 (3)	C7 (2)	D7 (3)	D4 (2)	
14	C6 (2)	C9 (3)	D9 (3)	D5 (2)	
15	C7 (3)	D2 (2)	D10 (3)	E1 (2)	
16	C8 (3)	D3 (3)	D12 (3)	E3 (3)	
17	C9 (2)	D4 (3)	E1 (3)	E7 (3)	
18	C11 (2)	D5 (2)	E2 (3)	E8 (2)	
19	D1 (3)	D6 (3)	E4 (3)	E9 (3)	
20	D2 (2)	D7 (3)	E5 (3)	E10 (2)	
				Total 17	
21	D3 (3)	D8 (2)	E6 (3)		
22	D5 (3)	D9 (3)	E9 (2)		
23	D6 (2)	D10 (2)			
24	D7 (3)	E2 (3)	Total 22		
25	D8 (2)	E5 (2)			
26	D10 (2)	E8 (2)			
27	D11 (3)	E9 (3)			
28	E1 (3)				
29	E2 (3)	Total 27			
30	E3 (3)				
31	E5 (2)				
32	E6 (2)				
33	E7 (3)				
34	E8 (2)				
35	E10 (3)				
36	E11 (2)				
	Total 36				

TABLE 13

Valid Items in Order of Difficulty Level on the Basis of Internal Consistency

Sr. No.	Sub-Test	Difficulty Level	Sub-Test	Difficulty Level	Sub-Test	Difficulty Level
1	A2	92.3	B1	92.2	C1	81.9
2	A5	87.0	B2	87.3	C2	71.1
3	A3	82.6	B3	77.3	C3	65.5
4	A4	82.2	B4	72.4	C5	59.9
5	A6	79.3	B6	61.5	C7	58.6
6	A8	78.1	B5	59.7	C4	53.1
7	A9	75.9	B7	59.	C9	46.0
8	A7	73.5	B10	44.5	C6	44.3
9	A10	70.3	B9	38.2	C8	35.0
10	A11	51.4	B8	37.	C10	30.5
11	A12	36.44	B11	35.3	C11	20.3
12	—	—	B12	29.9	C12	7.8
Total	11		12		12	
1	D1	77.7	E1	42.3		
2	D2	60.4	E2	36.5		
3	D3	57.6	E3	35.2		
4	D5	54.7	E7	19.6		
5	D4	50.8	E4	19.3		
6	D6	42.	E5	19.2		
7	D8	40.3	E6	18.6		
8	D7	36.8	E8	12.3		
9	D9	33.8	E9	10.3		
10	D10	26.1	E10	6.8		
11	D11	15.4				
12	D12	5.3				
Total	12		10		Grand Total	57

Summary :

Item analysis was done on the basis of Internal consistency and external criteria. It leads to the conclusions mentioned below :

(1) Item Analysis on the basis of Internal consistency suggests us that the item no. A1, E11, and E12 have not proved to be internally consistent with the children in Gujarat.

(2) Item Analysis on the basis of External Criteria (examination marks) leads us to suggest that more than half the number of items have proved to be valid.

CHAPTER 6

APPLICATIONS AND SUGGESTIONS

Applications :

1. (a) The Progressive Matrices Test when applied to secondary school going children in Gujarat is valid against the criteria, namely, Kohs' Block Design Test, an Intelligence Test of the Faculty of Education and Psychology, Baroda, and Examination Marks. The Validity Scores are .90, .53, .30 respectively.

(b) The test is reliable as calculated by Split-Half method. The Reliability Score is .89. Therefore, it may be used as a test of intelligence for testing secondary school going children in Gujarat.

2. The norms though significant range over 10 points for a period of 5 years (13 to 17). It means that one point is equivalent to six months in mental age. This suggests that the test will not be able to have delicate discrimation between individuals. Consequently, the test as it is seems to be more fitted for judging groups rather than individuals.

3. The correlation between Progressive Matrices Test and Kohs' Block Design Test is .90. It may be said that Progressive Matrices Test can be used as an equivalent test with Kohs' Block Design Test. Progressive Matrices being a Group test will be more convinient than Kohs' Block Design Test; which is an individual test.

Suggestions :

Inspite of having all positive results in the present study, it is felt that a further study may be taken upon the following lines :

1. The norms may be calculated on valid and discriminative items only. The norms thus calculated may be further studied against the norms presented in the present study.

2. The correlation with the standardized achievement tests may be calculated and studied against the present calculations.

BIBLIOGRAPHY

Anastasi A. "Psychological Testing", Macmillan and Co., New York, 1956.

Ballard P. B. "Mental Tests"

Burt, Cyril "Mental and Scholastic Tests" Staples Press, London, 1922.

Garrett H. E. "Statistics in Psychology and Education" Longmans Green and Co., New York, 1949.

Guilford G. P. "Psychomatric Methods" McGraw Hill Series, New York, 1953.

Hamley H. R. "The Testing of Intelligence" Evan Brothers, London, 1935.

Jordan A. N. "Measurement in Education" McGraw Hill Book Co. Inc., New York, 1953.

Kamat V. V. "Measuring Intelligence of Indian Children". Oxford University Press, Bombay, 1951.

Lindquist E. P. "Educational Measurement" American Council of Education, Washington, 1947.

Monroe W. S. "Encyclopedia of Educational Research" The Macmillan and Co., New York, 1950.

Rex Knight "Intelligence and Intelligence Tests" Methuen and Co., London, 1933.

Sandiford P. "Foundations of Educational Psychology" Longman's Green and Co., New York, 1940.

Spearman W. J. "Human Ability" The Macmillan and Co., New York, 1950.

Thorndike E. L. "Measurement of Intelligence" Columbia University, New York, 1927.

Vernon P. E. "The Measurement of Abilities" University of London Press, London, 1956.

JOURNALS AND OTHER PUBLICATIONS

British Journal of Psychology—Statistical Section, Vol. I, II, III, Part III, 1949.

Article by Gertrude Keir : " The Progressive Matrices as applied to School Children ".

Article by Vernon P. E.. " Indices of Item Consistency and Validity ".

British Journal of Psychology, November, 1955.

British Journal of Medical Psychology, Vol. XVIII, 1939.

Article by Raven J. C. and White A. : " Experiments on Physically Mentally Defective Children with Perceptual Tests ".

Psychological Monograph, No. 8, 1948, Article by Conard H. S. " Characteristics and Uses of Item Analysis Data ".

Psychological Monograph, No. 295, Vol. 62, No. 8 Article by Conard H. S.,

Publication by Board of Education : "Psychological Tests of Educable Capacity ".

Publication by Bureau of Psychology, No. 5, 1952 : " An Educational Guidance Project ".

Educational and Psychological Measurement

Articles :

By Rimoldi H. J. A. : " A Note on Raven's Progressive Matrices " Part I, Vol. VIII, No. 3, 1948 (Autumn).

By Cassel R. H. : " Qualitative Evaluation of the Progressive Matrices Test " Vol. IX, No. 2, 1949.

By Lenon R. T. : " Assumptions underlying the Use of Content Validity ", 1956.

Indian Journal of Psychology, Vol. XXXIX, Part I-IV, Calcutta, 1952.

Journal of Educational Psychology, (39) 1939

Articles :

By Flanagan J. C. : " General Consideration in the Selection and a Short Method of estimating the Productment Coefficient from Data of the Fails of the Distribution ".

By Kelley T. L. : " The Selection of Upper and Lower Groups for the Validation of Test Items ".

Modern Education, Vol. II, No. 2, January, 1953.

Article :

By Mathur V. S. : " Need for Intelligence Tests in India ". Teaching, December, 1952.

Article :

By Menzel E. W. : " Do's and Don'ts for Intelligence Testers in India and Pakistan ".

Modern Education, Vol. II, No. 3, April, 1953, Rajkamal Publications, Ltd., Delhi.

Progress on Educational Front, Central Education Ministry Report, Vol. XX, No. 2, August, 1953, (Masulipatam) 1952-1953. " Education in India ".