

# Construction and Standardization of Mathematical Reasoning Ability Test for Comparative Study of High School Students of Different Boards

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**Abstract:** The development of any nation depends on proper planning of its manpower. In present times it is necessary to measure powers of an individual and to guide him properly. The power of head, hand and heart of an individual should be measured properly. We can have a rough idea of his powers thro' his educational achievements and our own observations. Thus various types of tests are necessary. Various types of aptitude tests are used for measuring powers of students. In recent times for making a forecast of progress in various professions the aptitude tests are being used. Actually it is not proper. Because in many professions machine power, ability of hands and fingers, power of space and logical power are required in addition to the aptitude ability. Hence different Types of tests become necessary. Thus the forecast of success of an individual cannot be done on basis of aptitude indeed but by making measurement of special powers. Hence these types of tests have become important in developed countries of West. Gillard has imagined 180 types of such tests. To measure different type of abilities there are various types of tests like Alfa logical test, Numerical ability, Space ability, Handicraft ability and Musical ability test. The Mathematical Reasoning Ability test in education has been developed and standardized by the investigator meant for X<sup>th</sup> standard under different boards ICSE, GSEB and CBSE. The procedure of development of mathematical reasoning ability (MRA) test in education consists of planning, preparing, and item selection; try out, scoring and item analysis. The test initially consisted of 175 items, later item discussions with the experts and administration on the students, the items were reduced to 170. After through items analysis the final draft of the test reduced to 128 items. The test-retest method will use for reliability.

**Keywords:** Mathematical Reasoning Ability Test, High School Students, different boards ICSE, GSEB and CBSE.

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## 1. INTRODUCTION

The procedure to establish marks after making formation of test for the measurement of special tests and converting it in the proper position is said the certification. Certification of test means the fact of the test, which has been chosen and verified and on which the marks have been decided, the method to give it and to find out scoring, the examiner is given the marks and making scoring even if the equality is maintained and such method is developed like this and for easiest value, discriminatory identification value, time period or instructions, whose valuation is to be made with high level factual aspects and its trustworthiness and genuineness.

“A standardized test is one in which the procedure, apparatus and scoring have fixed, so that precisely the same test can be given at different time and places.”

*# As per opinion of R. N. Agrawal*

“Standardization implies uniformity of procedure in administration and scoring the test.”

*# As per opinion of A. Anastesi*

It can be concluded as per the aforesaid definition that certified test is the effective and trustworthiness weapon to make measurement in form of one scoring of prevailing position through the knowledge received by the student from the test given by the students in any of the field, proficiency, ability to do any one work and the ability to use the knowledge.

## 2. PURPOSE OF CONSTRUCTION MATHEMATICAL REASONING ABILITY TEST

The centralized purpose of the mathematical reasoning ability test was to evaluate MRA of high school students under Gujarat Secondary Education Board, Central Board of Secondary Education and Indian Certificate School Examination in the area of mathematics.

### **Target Population:**

This MRA test is mean for those students who have just passed IX<sup>th</sup> standard under different boards.

## 3. TYPES OF TEST ITEMS

The Mathematical Reasoning Ability Test consisting of all multiple choice items related to the selected topics was devised by the investigator keeping in mind the objective and content of the items. It was ensured that no objective remained untested. The following rules must be taken care while writing multiple choice items.

- Vocabulary used was appropriate for the level of test
- Each item was laid out in a clear and consistent manner
- Use of specific determents like always, never, etc was avoided
- Investigator used none of the above in few questions
- The number of test items framed initially was in large than the number of items retained finally

### **Preliminary draft of the test:**

After scrutinizing the items closely, the investigator prepared the preliminary draft of MRA test comprising of 175 items. In writing items, proper care was taken regarding coverage of content, structure, objective and difficulty of the test items. This test was given to 12 mathematical reasoning ability teachers/experts to

- Critically analyze the items for the content and language.
- Correct ambiguities
- Order of the items
- Add any other area of relevance
- Suggest any other relevant questions

Scoring key was also made and got scrutinized. Suggestions made by the MRA test experts were considered for framing the final draft. After obtaining feedback from experts, some items were modified and five defective were removed. In this way primary draft with 170 items was prepared.

### **Concept-wise distribution of items included in the preliminary draft:**

- Section-A:-Numbers of items-26, Based on different boards Text Book which includes few knowledge based items.
- Section-B: - Numbers of items-18, Based on Tables, Pie chart, Histograms and Others.
- Section-C:-Numbers of items-48, Based on Missing terms, Ratio-Proportion, Code-decode, Classification, Puzzles.
- Sections-D:-Number of items 23, Based on Adding & Subtraction, Multiply & Division, Power rules, Geometry, Changing Sign, Venn Diagrams.
- Section-E:-Numbers of items 55, Based on Non-Verbal's, Pictures, Similarity, Complete the picture, Water & mirror images, Make pairs, Complete Sequence.

**Try-out of the test:**

The preliminary draft of the test was administered to the sample of 24 students of class X studying in different boards of Gujarat. This attempt was made to check the difficulty level as well as to remove language problems faced by the students, if any occurring in the construction of the test. After the completion of the test the observations made by the students and problems faced by them were noted down and considered for revising the draft of the test. On the basis of the performance of the students out of 175 items, six items are changed and five items were discarded and in few items slight changes were made to improve clarity in the wording. Finally 170 items were retained which formed the first draft of the test.

**Final Try-out of the test:**

Final draft of the MRA test was administered to a total samples size of 100 students of slanted X<sup>th</sup> of different boards of Ahmadabad city of Gujarat. After the completion of the MRA test by the students, the answer key was collected by the investigator scored the answer key with the help of scoring key. Each item response marked correctly by the students was given 1 mark and 0 for wrong marked or omitted answer. Analysis of the performance of the students was based on the scores obtained by them.

**Item Analysis:**

After the scoring of the test, the items analysis was carried out from two angles i.e. qualitative as well as quantitative. The items were analyzed qualitatively in terms of their content and quantitatively in terms of their statistical properties. The statically technique used for selecting and rejecting the items was calculation of difficulty value and discriminating power for calculating difficulty value and discriminating power following procedure was followed:

- ❖ The answer sheet of the students was arranged in descending order.
- ❖ The top 27% formed upper group and the bottom 27% formed lower groups, according to Kelley's dichotomy.
- ❖ After that correct responses for each item in both the groups were calculated.

Each groups consisted of 27 students. As such difficulty value and discriminating index the following formulas were used:

The formula for discrimination index (D.I)

$$D.I = (R.H - R.L) / (N.H \text{ or } N.L)$$

- R.H – rightly answered in highest group
- R.L - rightly answered in lowest group
- N.H – no of examinees in highest group
- N.L - no of examinees in lowest group

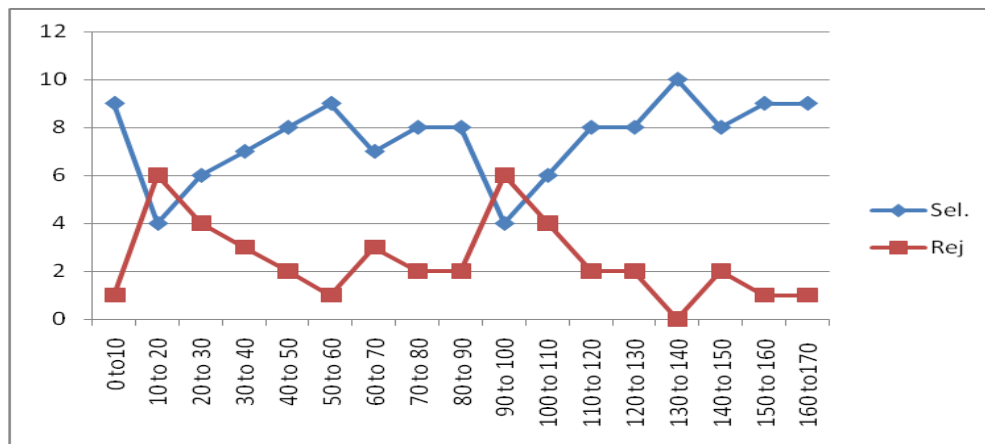
The formula for difficulty value (D.V)

$$D.V = (R.H + R.L) / [(N.H + N.L) - N.R]$$

- R.H – rightly answered in highest group
- R.L - rightly answered in lowest group
- N.H – no of examinees in highest group
- N.L - no of examinees in lowest group
- N.R – no of non-response examinees

The item in a test should neither be too easy nor too difficult, hence a balance between the two must be maintained. Any test to be called good measuring instrument must have some items of higher indices of difficulty ranging from 40 % through 60 % which should appear in the middle and some items of lower indices of difficulty which should appear at the end. But normally the items having the item difficulty between 20 % to 80 % are included in the test.

Table showing selected and rejected items:



#### 4. CONCLUSION

It is very difficult to make exact size (100 % fit) for everyone but we can make a standard size (Ingrident) for every one based on various scientific methods, which are used in a particular related field. In daily uses item like medicine, footwear, cloths, etc are based on standard. The findings of this paper have significance for students and investigator (test developer). They should be very careful while selecting items. The size of an acceptable item will depend upon the length of the test, range of difficulty indices and the purposes for which the test has been developed. The poor items are excluded or improved for the final test. Such practices can be used in other subject to develop a good item bank for pupil community. The need was felt to constant MRA test for assessing the MRA of the students in the subject at high school level.

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