

Construction And Validation Of Mathematical Aptitude Test For Secondary Level Learners

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Abstract

A test on aptitude is a structured assessment that aims to evaluate the candidates' talent and/or skill in accomplishing particular tasks without any prior knowledge or training. Assessing the basic mathematical skill of the candidates through an aptitude test can help highlight exemplary candidates who can really make a valuable contribution to their mathematical work in the future. This study focused on the construction and validation of mathematical aptitude test. The prime objective of the study was to construct and standardise an aptitude test in Mathematics for Std IX students. For this purpose, the investigator used the survey method. Fifty items of objective type were prepared. The test was administered to a sample of three hundred students in Thoothukudi. The content validity was found by the opinion of experts. The reliability coefficient was found to be 0.77.

Keywords: Mathematical Aptitude Test, Spatial Sense, Numerical Ability, Fluency Skill, Arithmetic Skill, Measurement Skill, Verbal Analysis, Problem Solving Skill.

Introduction

Every individual is unique. Each student possesses a different ability. Education is the key to bringing the latent potential of the students. It brings about a change in their behaviour which paves way for their success in life. Though the students get specific or specialized education and training, to our surprise, the percentage of successful students has been very less. The frequent question which always comes into the forum is what is the cause for the failure of students on a large scale in their fields. The reason for the above question may be the students are unaware of their potential which would have led them to select the wrong disciplines.

Aptitude is the natural learning ability, the individualistic ability necessitated to facilitate a career, suitability, preparedness,

tendency, natural or acquired disposition or capacity for a specific task. Tests on Aptitude are measures of cognition that assist in finding the future performance of students in school where they are engaged in activities (Aiken, 1988).

Aptitude testing

Aptitude testing is a great means of refining the thought process and skills of memory. These tests are used to find an individual's potential to get through a certain task, with no previous knowledge or training. Usually, the people who have thirst for research construct tests in areas where they are much more comfortable. Freeman (1971) has defined aptitude as a blend of characteristics focussing on the acquisition of an individual's capacity on certain skills only.

As we are living in the era of modernity, there is an ever increasing need for creation and innovation in students' mental faculties; Moreover, there is a swift forward movement in Science and Technology and this demand is intensifying. As we already know Mathematics is a science which is abstract, its uses are plenty in many fields. It is correlated with other subjects and is related to everyday life. This would have attracted the students towards Mathematics.

Success depends on various factors among which the possession of basic abilities is of vital importance. Parents' pressure forces them to choose the wrong one which in turn leads them to lose their physical and mental health. If the student's potential or talent is measured or at least estimated before he joins or chooses a field much wasted effort could be avoided. The measurement of aptitude is of paramount importance in this context. Hopefully, this study would enable students to find out their strengths and weaknesses to succeed in life.

The future of the students is decided by their Aptitude Tests (Chatterjee, 2007). The aptitude of each student is unique. It shows the proficiency of an individual (Ramsay 2008, Raza 2011). Kubiszyn and Borich (2003) have given a new word for aptitude as potential or ability. Gay (1971) has given the meaning of aptitude test as assistance and guidance for a teacher to assess the abilities of students in a practical way and also help in finding the underachievers.

The particular ability needed to enhance learning like for a career, preparedness, worthiness or natural or acquired disposition or capacity for a specific task or assignment (Raza 2011, Reeves 2002), and the intensity of preparedness to learn and do well in a particular situation or in a fixed domain (Raza 2011).

An aptitude test measures the holistic performance over a wide horizon of mental capabilities of the students. It comprises of verbal, and numerical skills which are bound to test the important skills of Mathematics.

Need for the Study

After careful review, it comes to light that there is very less number of the tools available for Std

IX school students for testing their Mathematics aptitude. Hence the present study was undertaken to conduct a study on the construction and validation of a Mathematical aptitude test for Std IX students in Thoothukudi.

Objectives

- To construct a test on Mathematical Aptitude (**Mathematical Aptitude Test-MAT**) for Std IX students.
- To validate the Mathematical Aptitude Test prepared for Std IX students.

Methodology

The investigator finds Survey method as given by Check J.& Schutt R. K. (2012) suitable for the present study.

Sample and Sampling Techniques

A random sampling technique as given by Cochran, W.G. (1999) was used in this study and a sample of 300 students was selected from an English medium school in Thoothukudi.

Construction of Mathematical Aptitude Test (MAT)

A critical review of literature and analysis of the dimensions and components covered by different aptitude tests which are already validated and applied by different researchers, lead the present researcher to develop a Mathematical Aptitude Test.

Description of the tool

This tool consists of 120 multiple choice questions. There are nine different domains essential for Mathematics. They are Spatial Sense, Logical Reasoning, Data Interpretation and Sufficiency, Numerical Ability, Fluency Skill, Arithmetic Skill, Measurement Skill, Verbal Analysis and Problem Solving Skill. Interest in the subject improves overall competencies and academic attainment of the students in a subject (Cilliers, et al., 1996; Seery, 2009).

Skills Tested

It was strongly felt by the researcher that learners' aptitude in Mathematics influences the computer adaptive test score. So the researcher tried to identify a suitable tool to collect data to study students' Aptitude in

Mathematics. After making a thorough study of various researches on the content area and development of the Mathematics Aptitude Test the researcher developed and standardized an inventory on Mathematics suitable for the sample.

1. **Spatial Sense:** The ability to transform and rotate an image that is visual and recall the relations between various real and fictional objects is called spatial skill. (Smit, S, 1998)
2. **Logical Reasoning:** This skill helps to evaluate contexts, choose techniques and methods to solve problems by creating solutions, etc. (Hill, 1960)
3. **Data Interpretation & Sufficiency:** Given two statements, the skill to find out whether the given data in the statements is enough to answer the given question. (Ashok Gupta, 2015)
4. **Numerical Ability:** The ability to understand, use, calculate numbers and their representation, etc. is referred to as Numerical Skill. (Abed, E. R., & Al-Absi, M. M., 2016)
5. **Fluency Skill:** The ability to recall or remember mathematical facts, concepts, terms, theorems, conjectures, etc. is termed a Fluency Skill. This skill gives confidence and this can be acquired through drill and practice. (Cartwright, K., 2018).
6. **Arithmetic Skill:** The skill of counting numbers and fractions and using the four fundamental operations is Arithmetic Skill. (Thorndike et.al., 1986; Wechsler, 1991)
7. **Measurement Skill:** This skill helps to quantify the things around us. The ability to make use of scales, rulers and utilize these tools and skills to calculate speed, velocity, acceleration, calculating perimeters, areas and volumes in everyday life. (Thom, R., 2002)
8. **Verbal Analysis:** The ability to understand and solve complex problems that are given in words. (Maulyda, et al., 2020).
9. **Problem Solving Skill:** The ability to solve problems in real life situations by applying Mathematics. (Lucia, M., 2003).

Table 1: Details of Mathematics Aptitude Test (MAT)

S. No	Skill Tested	No of Questions	Marks awarded
1	Spatial Sense	15	15
2	Logical Reasoning	15	15
3	Data Interpretation & Sufficiency	10	10
4	Numerical Ability	15	15
5	Fluency Skill	15	15
6	Arithmetic Skill	15	15
7	Measurement Skill	15	15
8	Verbal Analysis	10	10
9	Problem Solving Skill	10	10
Total		120	120

Validation of the Tool

With the opinions of seven experts - 3 Mathematics teachers, 2 professors and 2 researchers, the **content validity** of the tool on Mathematics Aptitude was established. Modifications were done based on their

opinions. The tool was revised and thus validated and finalized.

The discrimination power of the items and its difficulty level of the low and high groups were used to establish the **Item Validity** of the tool. The items whose difficulty index

was less than 40% and greater than 80% were not included in the final tool. Also items whose discriminating power less than **0.5** are not included in the final tool.

The **Concurrent Validity** was established by expert consensus. The average rating scores of the experts were compared with the inventory score. Pearson Product Moment Correlation 'r' was computed between the inventory score and experts' average rating score and the value of 'r' calculated was found to be **0.78**.

Reliability of the Tool

A test score is called reliable when we have reasons for believing the score to be stable and trustworthy (Garrett, 2010). The reliability of the tool was measured by Cronbach alpha test and the alpha value was found to be **0.77**.

Final Tool

A rough draft of questions on MAT was prepared and was presented to experts for their opinion and suggestions. Based on their feedback, certain modifications were carried out by the investigator and the modified tool was presented to the sample for collecting data for pilot study. Based on the response from the sample and by finding the reliability of revised tool items were further refined. Certain modifications were carried out to increase their validity. Language of the test items was made simple and lucid so that students can understand easily. Thus the final tool was prepared with more clarity. The final tool consists of 50 questions from Mathematics subject.

Table 2: Details of the Final Tool-Mathematics Aptitude Test (MAT)

S. No	Skill Tested	No. of Questions	Marks awarded
1	Spatial Sense	5	5
2	Logical Reasoning	6	6
3	Data Interpretation & Sufficiency	5	5
4	Numerical Ability	6	6
5	Fluency Skill	6	6
6	Arithmetic Skill	6	6
7	Measurement Skill	6	6
8	Verbal Analysis	5	5
9	Problem Solving Skill	5	5
Total		50	50

The final draft of Mathematics Aptitude test consists of 50 multiple choice questions. The questions measure the various mathematical skills and abilities of the students.

Educational Implications

1. This test will help us identify those Mathematics minded individuals, who are perfectly suitable in today's fast paced life, as seen in the modern societies.

2. This test has been designed to measure the aptitude of secondary students who intends to

take the subject Mathematics for his/her higher studies and wish to continue it. Esteem needs of the student are met by using mathematical aptitude test and pupils are recognized for their talents and abilities.

3. It would be very helpful in the field of educational and vocational guidance and counselling.

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