STEPS OF VALIDITY AND RELIABILITY OF ACHIEVEMENT TEST IN MATHEMATICS

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Abstract: For many people, mathematics is an enigma. Characterized by the impression of numbers and calculations taught at school, it is often accompanied by feelings of rejection and disinterest, and it is believed to be strictly rational, abstract, cold and soulless. But, if the students take interest in this subject, then they can achieve better in Mathematics. In this regard the researcher has made an attempt to create the interesting learning environment through an experimental study, "Effectiveness of Teaching Mathematics with Transitional Background Music on Mathematical Achievement, Interest in learning Mathematics and Attitude towards Mathematics among secondary School Students". In experimental studies, two kinds of information are needed. First of all, the nature of the sample and next is the measurement of desirable behavioral changes in the sample as a result of treatment variables. For collecting this information good instruments are required. Hence the researcher herself has constructed and standardized the tool that is the Mathematical Achievement Test. All the procedures followed and care was taken to assure that the tool had accepted the level of validity and reliability.

Key Words: Validity, Reliability, Mathematical Achievement and Standardization.

Introduction

Mathematics has become one of the most important subjects in the school curriculum during this century. As modern societies have increased in complexity and as that complexity has accompanied rapid technological development, so the teaching of mathematics has come under increased scrutiny. Mathematics has played a significant role in building our civilization. The Education Commission (1964-66), and the National Policy on Education (1986) has underlined the importance of Mathematics Education. Therefore, Mathematics is a compulsory subject at school level. If the students take interest in this subject, then they can achieve better in Mathematics. But the fact is that there is more failure of students in Mathematics. For many people, mathematics is an enigma. Characterized by the impression of numbers and calculations taught at school, it is often accompanied by feelings of rejection and disinterest, and it is believed to be strictly rational, abstract, cold and soulless.

The aim of this investigation was to study the effectiveness of teaching mathematics with transitional background music on mathematical achievement among secondary school students. In experimental studies, two kinds of information are needed. First of all the nature of the sample and next is the measurement of desirable behavioral changes in the sample as a result of treatment variables. For collecting this information good instruments are required. Hence the researcher herself has constructed and standardized the tool. Care was taken to assure that the tool had accepted the level of validity and reliability.

Mathematical Achievement Test

The Achievement test was constructed keeping in mind the objectives, such as knowledge, understanding, application and skill of the students. The text book prescribed by the Government of Karnataka for IX standard was used in the construction of the test. The researcher considered four lessons from the Karnataka State Board text book which usually consider to teach in the months of December to February (2016) in the Government school year plan. These topics were considered from all the three parts of mathematics. A lesson Hire Purchase and Installment

Buying is from arithmetic, Simultaneous Linear Equations lesson is from algebra and Circles and Concurrency in Triangles lessons from Geometry.

The lessons taken for the test were,

    1. *Hire Purchase and Installment Buying*

    2. *Simultaneous Linear Equations*

    3. *Circles*

    4. *Concurrency in Triangles.*

At the initial stage preliminary draft was prepared corresponding to four concepts of mathematics of IX class. This draft consists 66 items covering the major objectives of teaching; knowledge, understanding, application and skill in mathematics at the secondary stage. Items having similar concepts were grouped at one place; Items were multiple types, i.e. every item was fed with four options in which only one option was the appropriate answer. Here the students were expected to answer the questions by selected the right option from among the four listed responses. All the items were evaluated by the experts as well as by the investigator in order to remove vagueness, ambiguous terms and language difficulty in the format of test items. 8 items were deleted and a few items were modified as per suggestions received from the experts. In this way preliminary draft with 58 items was made.

Validity of the Test:

The test was validated against the criteria of content validity. The content validity is concerned with the logical adequacy of sampling of a specified universe of contents. To determine the content validity the test items, the panel consisting of six experts in the subject matter. The panel was asked to identify which test items corresponded to which outcome. The panel also completed the test so that the scoring key could be verified. The experts agreed with the investigator on the assignment of the test items to objectives 90%. This concurrence of percentage was taken as evidence of content validity.

Item Analysis

After validating, the test items were administered on the 50, IX passed students of Holekoppa Govt. High School, Sringeri. This attempt was made to check the difficulty level as well as any language problem occurring in the construction of the test. All these students were having a difference in the achievement in mathematics. All the students were given a separate answer sheet on which they were supposed to mark the right answer, after giving the required instructions about the test. There was no time limit and time taken by every student was noted down. Out of 58, 8 items were found to be confusing/difficulty with the students. Thereby out of 58 items, 8 items were removed from the draft. Consisting 50 items were prepared keeping in view the nature of content as well as difficulty level.

The Difficulty value of the test items:

The difficulty value of each of the items was calculated by using the following formula:

$$d = \frac{N_H + N_L}{N_T} \times 100$$

Where, d = Difficulty of the item

N_H = Number in higher group answering the item correctly

N_L = Number in lower group answering the item correctly

N_T = Total Number of pupils who answered that item

The Discriminative value of the items:

100 Students for the final tryout were arranged in descending order of their performance. The student getting highest marks was ranked first; the student next higher marks were ranked second and so on. Thus the student getting lowest marks was ranked 100th. After arranging the students in descending order of their performance, they were classified into three groups. The first group is termed as higher group consisting 27% of the top students which comes out to be 27. The second consisted of the next 46 students, which formed middle 46% of the total students. The third group termed as lower group which consisting of 27% of the total students on the lower side, it again consisting of 27 students. In order to find out the discriminative value of the various items, the two groups- higher and lower consisting of the top 27% of the students and bottom 27% of the students were compared.

The Index of discrimination is determined by using the formula

$$D = \frac{N_H - N_L}{N_t}$$

Where, D = Difficulty of the item

N_H = Number in higher group answering the item correctly

N_L = Number in lower group answering the item correctly

N_t = Total Number of pupils either in high or low group

The process of Item analysis revealed that only 40 items were retained out of 50 items (The item difficulty and discrimination level of the achievement test is given below)**.**

Table- 1: Difficulty and Discriminative Indices of the Items selected for the achievement Test for IX standard.

Item No	H-L	Difficulty Index	Discriminative Index
01	12-5	60.71	0.50
02	11-4	53.57	0.50
03	12-2	50	0.71
04	11-4	53.57	0.50
05	10-4	50	0.42
06	11-12	82.14	-0.07
07	12-2	50	0.71
08	07-1	28.57	0.42
09	11-2	46.42	0.64
10	11-3	50	0.57
11	12-13	89.28	-0.07
12	14-13	96.42	0.07
13	14-9	82.14	0.35
14	11-2	46.42	0.64

15	12-6	64.28	0.42
16	14-11	89.28	0.21
17	13-5	64.28	0.57
18	14-5	67.85	0.64
19	12-10	78.57	0.14
20	13-5	64.28	0.57
21	11-6	60.71	0.35
22	12-5	60.71	0.50
23	12-13	89.28	-0.07
24	13-4	60.71	0.64
25	13-4	60.71	0.64
26	13-8	75	0.35
27	11-5	57.14	0.42
28	11-6	60.71	0.35
29	13-7	71.42	0.42
30	11-12	82.14	-0.07
31	8-3	39.28	0.35
32	7-0	25	0.50
33	10-4	50	0.42
34	12-2	50	0.71
35	11-6	60.71	0.35
36	10-9	67.85	0.07
37	14-8	78.57	0.42
38	13-4	60.71	0.64
39	10-7	60.71	0.21
40	14-5	67.85	0.64
41	13-5	64.28	0.57
42	12-5	60.71	0.50
43	12-3	53.57	0.64
44	14-9	82.14	0.35

45	11-5	57.14	0.42
46	10-4	67.85	0.42
47	12-7	67.85	0.35
48	13-7	50	0.42
49	14-05	67.85	0.64
50	8-6	50	0.14

Final tryout of the test:

The test was administered to 100 students in X class who had just passed IX class exams, for final tryout. The answer sheets were scored with the help of scoring key. Each correct answer was given the score of one and total scores obtained by the student was the total number of correct answers.

All those items were selected for the final test which have difficulty value as well as discriminating value of 0.30 - 0.80. In this way the total number of items selected for the final draft of the test was 40. These 40 items selected after the final tryout had to be placed in order of difficulty. In this way the final form of Achievement Test in mathematics comprised of 40 items. Finally, instructions were carefully reviewed and modifications were done wherever necessary. The time limit of the test was fixed on the basis of the time taken by 90 percent of the students on the final tryout, which was 45 minutes, including 5 minutes for instructions.

Reliability of the Test:

The term reliability has been considered by Anne (1982) as the consistency of the scores obtained by the same individuals on different occasions or with different sets of equivalent forms. The test retest method of reliability was found to be the most suitable for the Achievement Test in Mathematics. Hence, for the present study test-retest method was used to find out the reliability co-efficient.

Forty items were used for Reliability Test by taking 104 samples from Darshini Composite School, B.G.S Campus, Sringeri, Karnataka. The Mathematical achievement test was administrated to 104 secondary school students and the data were collected. The same test was administrated to the same sample with three weeks interval, again the data was collected. The correlation was computed and the result of the test shows that the correlation coefficient was calculated as 0.939 which is highly positively correlated. It indicates that the scale has a high reliability value. Finally the Achievement Test found 0.939 highly positive correlations from Test-Retest method.

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