CONSTRUCTION AND STANDARDIZATION OF ACHIEVEMENT TEST IN SCIENCE

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Abstract

The test of achievement in science for class IX under the Punjab School Education Board was developed and standardized by the investigator. Planning, organizing, choosing items, testing, scoring, and item analysis are the phases in developing an achievement test in science. Originally designed with 90 items, the test was refined to include 45 items after expert consultation, small- and large-group testing, and item analysis. After a gap of 20 days, the test's test-retest reliability was determined to be 0.87. By creating a blueprint of the test items with the weights assigned to the objectives and consulting with an expert panel, the content validity was determined. The test was set with a 55-minute time limit.

Key words*: Achievement test in Science, IX class, Validity, Reliability, Achievement, and Item Analysis.*

Introduction

A scientific body of information, as well as a way of thinking and living, are measured. Different people define science differently based on their own experiences, backgrounds, exposures, and personal descriptions. "Science is not just a collection of laws, a list of unrelated facts," asserts Bodner (1986). It is also a creation of the human mind, with its spontaneous notions and ideas. Whether and how the theories connect through the world of sense impression is the only explanation for the mental assembly.

Any body of knowledge that deals with the physical world and its events and is founded on impartial observation and systematic experimentation is referred to as science. Researching fundamental principles or universal truths is usually the focus of science (Encyclopaedia Britannica, 2023).

Academic success is associated with the acquisition of concepts and generalizations as well as the capacity to carry out certain manipulations, goals, symbols, and ideas.

Academic achievement is the progress achieved toward the goal of obtaining educational skills, resources, and information. It usually encompasses a variety of disciplines. It is related to success in academic contexts rather than the general acquisition of knowledge in non-academic settings (Bolt, 2011). In the field of educational psychology, academic achievement refers to a student's level of competency in academic subjects as a whole or in a particular subject, like arithmetic or reading. The outcomes of standardized ability tests and performance evaluations by teachers or other supervisors typically serve as indicators of future academic success (American Psychological Association, 2022).

Academic achievement, according to Gbati (1988), is defined as a student's numerical results that indicate how well-adapted they are to their coursework and the educational system. Thus, in order to evaluate academic achievement, standardized achievement tests are necessary. Before developing the achievement test, the researcher reviewed the several science-related tests that were currently available for administration. After consulting with the Punjab School Education Board, it was decided that an achievement test based on the most recent Science syllabus of class IX would be required. To achieve the stated objective, a number of tests were examined, and discussions were done with experts in the field of science education from both high school and colleges.

1. Construction of the achievement test

Examining the science understanding of Punjab School Education Board class IX students was the aim of the test. Learning objectives pertaining to scientific knowledge, comprehension, and application were considered throughout the development of achievement test items. Before the test was developed, the science themes for the ninth grade under the Punjab School Education Board were thoroughly reviewed. Numerous tests were closely monitored and examined before to the test's creation.

1.1 Purpose for creating the test

The test's objective is to assess secondary school pupils' scientific achievement.

1.2 Target population: Students who recently completed their IX class course make up the target group.

1.3 Test items for the achievement test

The main objective of the achievement test in this study is to evaluate how well students learn science when provided with certain teaching strategies, such as lectures and experiential learning. The test comprised both multiple-choice and fill-in-the-blank questions to assess the students' knowledge of science. The following considerations were used when composing the items:

(1) The items were written in a way that prevented any possibility for misunderstanding.

(2) Less significant aspects of the topic matter were not covered by the items; only the essential elements of knowledge and comprehension were assessed.

(3) The objects were maintained independently of one another.

(4) There was no combining of two goals into one item.

(5) The keyed responses were rearranged at random in their locations.

(6) Every effort was made to guarantee that the items would not encourage speculating.

2. Planning of the achievement test

The first and most important step in creating an achievement test is test planning. Since meticulous and precise planning is a sign of development, an achievement test necessitates it. The test creator must take into account crucial factors including the subject matter, degree of difficulty, kind of pupils, and what, when, and how to assess. In this instance, choices regarding the order of the objectives, the number of sub-tests to include, the topics to cover, the number and kind of items to include, the duration of the test, the amount of time it will take, the method of evaluation, etc., have to be decided ahead of time.

Punjab School Education Board, Mohali, Punjab, India-affiliated government schools in the Ludhiana district that have IX class pupils enrolled were the target population.

Both the test's content and its items had careful consideration. Before test items were created, numerous tests were closely monitored and examined. The achievement item documentation that was supplied was clear and concise to read. The test format was determined, along with the forms and quantity of questions.

2.1 Objective of the test

Objectives in this achievement test were defined in behavioural terms focusing on knowledge, understanding and application from the 6 units of Science curriculum of IX class prescribed by Punjab School Education Board.

S.No.	Objective	Percentage of item measuring objective
1.	Knowledge	27.90
2.	Understanding	28.80
3.	Application	24.30

2.2 Content of the test- Investigator selected six chapters of science Class IX Science Text Book issued by Punjab School Education Board, Mohali. Two chapters each from Physics, Chemistry and Biology.

Sr. No.	Chapters	Number of items
1.	Matter Around us	15
2.	Is Matter Around us Pure	15
3.	Motion	15
4.	Force and Laws of Motion	15
5.	Natural Resources	15
6.	Fundamental unit of Life	15

2.3 Size of the test- The targeted science topics were used to generate a total of 90 questions.

2.4 Preparation of Blue Print- The content is arranged in a three-way grid, and the test objectives are arranged along a horizontal axis. The three-dimensional chart includes a list of the test objectives, topics to be covered, and question styles. When developing the achievement test items, learning objectives like as knowledge, comprehension, and application in science were taken into account.

3. Preparation of Achievement Test

It Consist of three steps:

- Item writing
- Checking by expert
- Item Editing

The researcher developed an accomplishment test with multiple-choice and fill-in-the-blank questions after giving great thought to all of the previously listed possibilities. Six chapters from the ninth-grade science textbook were selected in order to prepare for the test. Ninety questions in all were generated using the specified science topics.

Seven science experts from different schools and colleges were consulted about this test in order to gain their insightful opinions and important input. Expert advice led to the removal of fourteen questions from the test. Expert recommendations helped the researcher design an overview of 76 multiple-choice questions..

4. Administration of the test

4.1 Small Group Try Out: 35 students in the tenth grade at the Narotam Vidya Mandir Senior Secondary School Khanna, District Ludhiana, Punjab—affiliated with the Punjab School Education Board Mohali- were given the 76 multiple-choice questions test.

Out of the 76 items, 16 were eliminated due to their ambiguous options, difficult language, or additional unknowns. Once the challenging test items were eliminated, a blueprint and an outline of 60 test items were made, and the system was prepared for large group testing.

4.2 Large group try out (Final try out): The final draft of the achievement test was taken by 174 students from two private schools (A.S. Senior Secondary School, and M.G.C.A.S. Model High School, both in Khanna, District Ludhiana, Punjab affiliated to the Punjab School Education Board, Mohali). Test results were assessed and graded using an answer key after administration. One point was awarded for correct responses, zero for incorrect ones, and zero for blank ones. This criterion was used to determine the total number of marks.

5. Item Analysis: Test items are selected and eliminated based on their discriminative power and difficulty value using item analysis. One by one, the statistical identification of each question's suitability was done.

Difficulty value= (R.U. + R.L.) / (N.U. + N.L.) (Marie & Sreekala, 2015)

R.H. = Correct answers in the higher group

R.L. = Correct response in lower group

N.U. = The number of pupils in the upper group.

N.L= The number of pupils in the lower group.

D.P. = (R.U.-R.L.) / (N.U. or N.L.)

R.H. = Correct answers in the upper group

R.L. = Correctly answered in the lower group

N.U. =The number of pupils in the upper group.

N.L.=The number of pupils in the lower group.

On the basis of DP and DV values 26 items rejected . In the final achievement test 34 were kept out of 60 items.

Blue Print of Final Draft of Achievement test of Science

Unit No.	Name of Unit	Knowledge	Understanding	Application	Total
1.	Matter Around us	1	3	1	5
2.	Is Matter around us Pure	1	4	1	6
3.	Motion	1	1	1	3
4.	Force and Laws of Motion		2	4	6
5.	Improvement in Food Resources	5	0	0	5
6.	Fundamental unit of Life	5	3	1	9
	Total	13	13	8	34
	Weightage	38.24%	38.24%	23.52%	100%

6. Reliability of the achievement test

It shows how bias-free (error-free) it is, which guarantees consistent measurement across time and among the different items on the test (the observed scores). It is the extent to which an evaluation tool yields results that are consistent (error-free) and reliable (Haradhan, 2017). It assesses a research study's accuracy, consistency, and reliability (Chakrabartty, 2013). The test-retest method was employed in the current study to assess reliability.

A sample of 68 pupils from Nankana Sahib Senior Secondary School Kalal Majra, District Ludhiana, Punjab; were tested, and the same students were tested again 20 days later. The results of the first test and the second test were found to have a 0.87 product moment coefficient of correlation. The coefficient of correlation has a relatively high value, indicating the reliability of the science performance test.

7. Validity of the Scale

The meaning of "validity" is related to the objective that the test is supposed to accomplish. To put it another way, a scale's validity is determined by how well it assesses the variables it is designed to measure (Brame, 2013).

To ascertain the test's face validity and content, experts and the supervisor conferred. The experts agreed that the test questions were related to the appropriate objective. This method assisted the investigator in evaluating the face and content validity of the science achievement test.

8. Time limit of the test

A test's time limit should be standardized to ensure that there are no anomalies and that every student is subjected to the same conditions. To find out how long it would take each student to finish the test, the investigator timed each student while administering the test. An average of 55 minutes was found to be the time taken by 95% percent of students. As a result, it was chosen as the test's time limit.

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