Journal of Education and Practice
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.17, No.10, 2026

Construction and Standardization of a Scientific Reasoning Test in Physics for Class-VIII Students

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ABSTRACT
Physics is a concept-based subject. To acquire the knowledge on the subject, one must possess higher-order cognitive skills. Construction and standardization of a Scientific Reasoning Test is a basic tool in understanding the cognitive ability of the students. The present study targeted to construct and standardize Scientific Reasoning test in Physics for school students studying in Class-VIII. For constructing the Scientific Reasoning Test, 50 test-items were selected from the 95 test-items after item analysis. A sample of 704 students was selected purposively from the eleven schools. The Pearson Product-Moment formula was employed to find the reliability coefficient of the test. The reliability coefficient for the English version of the test was 0.73, while it was 0.69 for the Assamese version (vernacular language). The reliability coefficient of the test was recorded as 0.83 while calculated for both the language English and Assamese (vernacular) jointly. The present study revealed that the constructed Scientific Reasoning test is quite satisfactory and can be used as an assessment tool for determining the Scientific Reasoning ability of Class-VIII students in Physics.
KEYWORDS Cognitive ability, Item analysis, Reliability coefficient, Secondary school.
DOI: 10.7176/JEP/17-10-01
Publication date: October 30th 2026

INTRODUCTION

Physics is an important branch of science consisted of many theories and concepts that describe the fundamental process of nature. Every aspect of our lives is dominated by the fundamental ideas and theories of Physics. Therefore, understanding the basic concept of the subject at the school level is an essential part of any learning process. It is argue by many researchers that from the school level, students must be able to hold the basics of Physics in addition to knowing the subject matter as facts, concepts, or principles (Frost and Turner 2005; Tajudin and Chinnappan 2016). There is relatively little scope for memorization and rote learning in Physics (Ekici 2016), the present educational system must include different teaching practices and incorporate thinking skills memorization techniques in the curriculum to ensure the development of students that will enable them to think critically and developed their thinking ability (Can and Kaymakci 2015; Ozcan 2020). Higher-order thinking skills such as Reasoning, analyzing, evaluating, etc. can activate and use all of their working memory resources in a controlled and supervised way (Veiga et al. 2018; Wani and Hussain 2024). Many researcher opined that good Reasoning can help in correctly understanding the concepts of Physics and have positive relationship between formal Reasoning and conceptual understanding (Supeno et al. 2018). Higher-order cognitive skills is essential to understand the concept of Physics.

Scientific Reasoning is a higher order cognitive skills comprises the logical thinking and problem-solving skills, which is required to understand the basic fact of any subject. This is a type of cognitive skill used in institutional education also involves practical and mental activities to enrich the learning process of Physics (Zimmerman 2005).Physics based learning process enhanced the mental and physical activity (Ates and Eryilmaz 2011). Hence, a systematic evaluation of scientific thinking among students is important step for science teaching and learning. The evaluation of student ability is done mainly by verbal and written assessment (Apino and Retnawati 2017). The written assessments can be measured by a test, which is an assessment tool or standard procedure used to intelligence level by posing a set of questions (Dickson et al. 2020). An ideal test construction required several detailed steps (Eze et al. 2017). Researcher who is engaged in the test development activity, one needs to start with constructing the variables. Thus the constructed test is required to standardize. A test with standard administration, scoring, and interpretation practices is known as a standardized test. The standardized tests constructed by the researchers are standardized in terms of how they were scored and administered under consistent, standardized testing environments, allowing the findings from various samples to be properly compared (Mana and Mete 2021). The quality of a test depends on the quality of the prescribed curriculum.

To ensure the quality of a test, evidence of validity and reliability are required (Kimberlin and Winterstein 2008). The consistency of the test is referred to as reliability, whereas the truthfulness of findings is referred to as validity (Mohajan 2017). A test is said to be valid if it is capable of retaining what is being tested (Facione et al. 2000). Types of validity include content or curricular validity, criterion-related validity, and construct validity. For the present study, the researcher used content validity. By analyzing the contents of each test item

individually as well as together, the content validity was estimated. This method is used for measuring educational performance and proficiency (Singh 2015).

The reliability of a test refers to the consistency of the score or measurement which is reflected in the reproducibility of the scores (Singh 2015). Reliability is the degree to which a measurement instrument produces consistent results when tested and re-tested as well as the degree to which a test is internally consistent. Test-Retest reliability (temporal stability) over time, internal consistency among items, and inter-rater reliability among different researchers are the three types of consistency (Heale and Twycross 2015).

The Test-Retest technique for determining reliability has been considered by the researcher to be suitable for the study. In this technique, a test is administered twice to the same group under the same conditions. The reliability coefficient can be estimated by correlating the two sets of scores from the same test. Pearson Product Moment correlation is used to estimate the reliability of the tests. The value of the reliability coefficient should be between 0.00 and 1.00 and should not have a negative value. The value of reliability coefficient 0.70 is considered satisfying (Fraenkel et al. 2012).

As Physics is consisted of many theories and concepts that describe the fundamental process of nature. Therefore, understanding the basic concept of the subject at the school level, good Reasoning is essential.

As the subject contains many theories and concepts, therefore good Reasoning is essential to understand the basic concepts of the subject. Although construction and standardization of test in many science subjects such as Chemistry, Biology, Mathematics, etc. are carried out but no such study has been done in Physics in India, hence there is research gaps, which is cover in the present study. The Scientific Reasoning test for Class-VIII students was developed under the Classical Test Theory (CTT) framework. The Classical Test Theory (CTT) is the well-established and broadly used frameworks in educational and psychological measurement. It gives us a base for constructing, analysing, and interpreting the test scores. From the CTT, we come to know that the observed score obtained by a student in a test is composed of two parts i.e. the *true score* and the *error score*. The true score means the actual ability of the students which is being measured, while the error score means the effects of the factors which are unrelated to the construct. In the construction and standardization of the Scientific Reasoning Test in Physics for Class-VIII students, CTT gave the researcher a guiding framework. From the CTT framework the researcher selected 50 test items out of the initial pool of 95 items, by using item analysis, where each item of the test give its contribution to measure the Scientific Reasoning skills. The reliability of the test was estimated by using Pearson's Product Moment correlation, which gave the acceptable reliability coefficients (0.69 for Assamese version, 0.73 for English version, and 0.83 when both versions were combined). This show that the CTT framework of emphasizes the test consistency and dependability. Validity was estimated by making the items in dimension wise of Scientific Reasoning and by using expert judgement. Because of these reasons, with comparison with the other modern psychometric models, the researcher used the CTT framework for the development of the Scientific Reasoning test in Physics.

RESEARCH QUESTION

what extent a multiple-choice Scientific Reasoning Test in Physics for Class-VIII students is valid and reliable for assessing the Scientific Reasoning ability across different Reasoning dimensions?

TITLE OF THE STUDY:

The title of the present study is, **"Construction and Standardization of a Scientific Reasoning Test in Physics for Class-VIII students."**

OBJECTIVES OF THE STUDY:

The main objective of the study was to construct and standardize a Scientific Reasoning Test in Physics for school students studying in Class-VIII.

In accordance with the objective, the following sub-objectives are followed:

1. To prepare a draft of the Scientific Reasoning Test in Physics for Class-VIII students.
2. To try out the draft of the Scientific Reasoning Test in Physics for Class-VIII students.
3. To make item analysis of the draft of the Scientific Reasoning Test in Physics for Class-VIII students.
4. To make selection of test-items for final draft of the Scientific Reasoning Test in Physics for Class-VIII students.
5. To determine the validity of the Scientific Reasoning Test in Physics.
6. To determine the reliability of the Scientific Reasoning Test in Physics.

DEFINITION OF THE KEY TERMS:

Scientific Reasoning in Physics:

Scientific reasoning is a type of cognitive ability which apply the logical and critical thinking skills for analysing problems, for constructing hypotheses, for designing experiments, for interpreting evidence, and to draw valid conclusions. It is central to science education and crucial for developing scientific literacy (Lawson 2000).

In the present study, the total scores obtained by the students in the Scientific Reasoning Test in Physics are considered as the scientific reasoning of the student. In the Scientific Reasoning Test in Physics, the higher the scores higher the scientific reasoning in physics. The test contained multiple-choice test items comprising the five dimensions, namely inductive reasoning, deductive reasoning, analogical reasoning, eclectic reasoning, and classification as reasoning.

Inductive reasoning is a decision making process where conclusions are drawn from the given data, principle, fact and statement. It always moves towards giving general conclusion from the specific one.

Deductive reasoning is the ability to identify the specific principles from the generalized information.

Analogical reasoning helps in finding out the similarities and differences between two or more ideas or concepts. Analogical reasoning gives a way to identify a systematic connection between two set of data to get a probable decision.

Eclectic reasoning is the capability of selecting the best option from the given alternatives. It is considered as a mental process. It selects the best preferences from judging and discriminating the others.

Classification as reasoning is defined as the capacity where conclusions are drawn by classifying the concept. Based on some common qualities it sort the items or concepts and then chose the item which is different from the other.

The Scientific Reasoning Test is based on the selected contents from the science textbook of Class-VIII prescribed by NCERT. The chapters of physics from the science textbook of Class-VIII are shown in table 1.

Table 1: Chapters from the Science textbook of Class-VIII

Sl. No.	*Name of the Chapters*
1.	Force and pressure
2.	Friction
3.	Sound
4.	Chemical effects of electric current
5.	Some natural phenomena
6.	Light
7.	Stars and the Solar System

Standardization:

Standardization of a test implies uniformity of procedure in administering and scoring the test (Anastasi and Urbina 2019)

In the present study, standardization refers to the estimation of reliability and validity of the Attainment Test in Physics, Scientific Reasoning Test in Physics, and Achievement Test in Physics for Class-VIII students.

METHODOLOGY

Method of the study: Considering the nature of the objectives and types of data to be collected descriptive survey method was used in the study.

Population: The population of the study comprised of all the Class-VIII students of Sivasagar District and Charaideo District, Assam, India.

Sample for Construction and Standardization of the Scientific Reasoning Test in Physics

The sample for construction and standardization of the Scientific Reasoning Test in Physics are given below-

Sample for try-out of the Scientific Reasoning Test in Physics:

The researcher had purposively chosen Class-VIII students from seven schools from Charaideo District (three English medium and four Assamese medium) to conduct the present study. The Scientific Reasoning Test in Physics for Class-VIII students was administered to a group comprising of 303 students studying in Class-VIII in the selected schools.

Sample for estimating the reliability of the Scientific Reasoning Test in Physics:

The researcher had chosen five schools from the Charaideo and Sivasagar District (two English medium and three Assamese medium) to collect the data for standardization using the purposive sampling technique. The data were collected from the students of Class-VIII studying in these schools. The reliability of the test was calculated using the Test-Retest technique. The test was administered twice to a group comprising of 401 students studying in Class-VIII in the selected schools.

The samples were different from the samples for the try-out of the Scientific Reasoning Test in Physics.

The distribution of sample for construction and standardization of the Scientific Reasoning Test in Physics are shown in Fig 1.

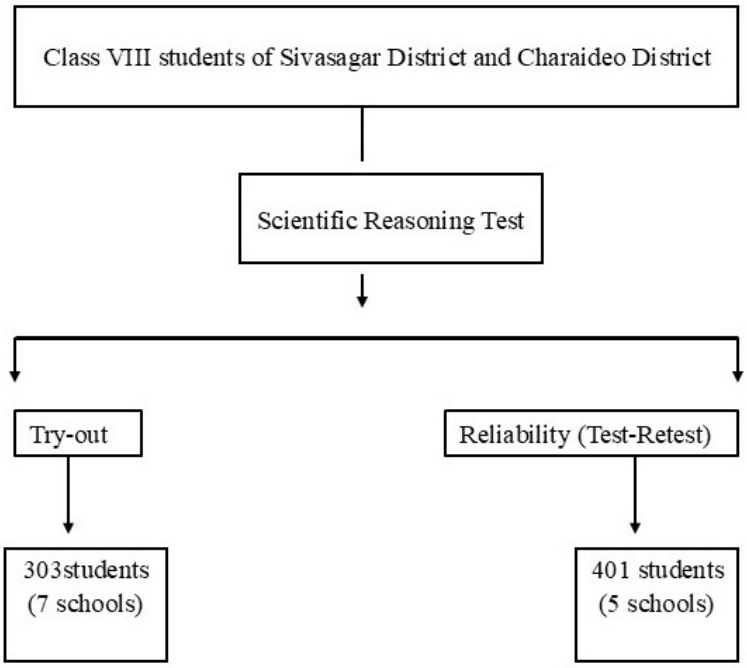


Fig. 1. Distribution of sample for Construction and Standardization of the Scientific Reasoning Test in Physics.

Data Collection (for both tryout and estimating reliability):

To collect the data from the sampled students, the researcher first took permission from the inspector of schools Sivasagar district and Charaideo district,Assam, India. With proper permission, the researcher then visited the selected schools and also took permission from the principals and headmasters to administer the tests to their students.

The data collection process for the mentioned tests was done in two phases-

In the **first phase**, the researcher visited the selected schools to try out the draft Scientific Reasoning Test in Physics for Class-VIII students. After the try-out, the researcher analyzed the items of the tests and finalized items for the final tests.

In the **second phase**, the researcher again visited the schools which were different from the first phase to estimate the reliability of the tests. The Test-Retest technique of determining reliability has been considered to

be a suitable technique of estimating the reliability of the tests. So, the researcher administered the same tests among the same group of students following the same procedure giving a time gap of five days.

ANALYSIS OF THE DATA

To construct and standardize the Scientific Reasoning Test in Physics for the Class-VIII students following steps are used. The steps are:-

i. Planning of the test

ii. Preparation of the test

iii. Item analysis

iv. Standardization of the test

The steps of construction and standardization of Scientific Reasoning Test in Physics for the Class-VIII students have been shown in Fig-2.

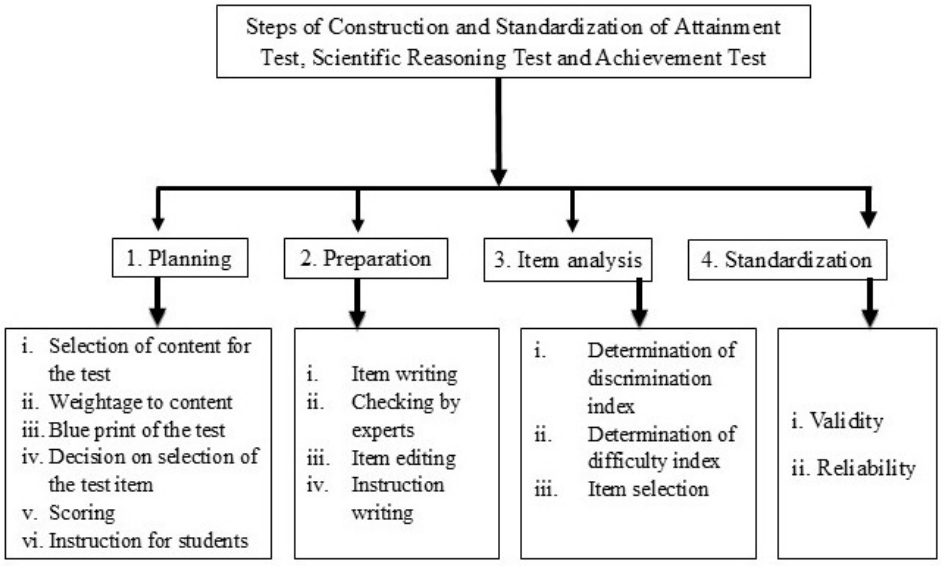


Fig. 2. Steps of Construction and Standardization of the Scientific Reasoning Test in Physics

i. Planning of the test:

Scientific Reasoning Test was constructed and standardized by the researcher to measure the scientific reasoning in physics of Class-VIII students. The Scientific Reasoning Test in physics contained multiple-choice items that comprised the five dimensions: inductive reasoning, deductive reasoning, analogical reasoning, eclectic reasoning, and classification as reasoning. Each item has four (4) options. The weightage allotted to the dimensions of the Scientific Reasoning Test in Physics of the Class-VIII students is shown in Table-2

Table 2: Weightage allotted to the dimension of Scientific Reasoning Test in Physics

Sl. No.	Dimensions	Number of test items
1	Inductive Reasoning	10
2	Deductive Reasoning	10
3	Analogical Reasoning	10
4	Eclectic Reasoning	10
5	Classification as Reasoning	10
Total		**50**

This test was based on the selected contents from the science textbook of Class-VIII prescribed by NCERT (National Council of Educational Research and Training) (Uppal, 2008)[10].There are eighteen (18) chapters in the science textbook of Class-VIII from which seven (7) chapters of physics were selected. The chapters of physics from the science textbook of Class-VIII are shown in Table-3

Table 3: Chapters from the Science textbook of Class-VIII.

Sl. No.	*Name of the Chapters*
1	Force and pressure
2	Friction
3	Sound
4	Chemical effects of electric current
5	Some natural phenomena
6	Light
7	Stars and the solar system

The test was constructed in Assamese and English language. A response sheet was prepared which provides space for students to fill in details such as their name, class, school, date, and their response to each item. The blueprint of the Scientific Reasoning Test in Physics of the Class-VIII students is shown in Table-4

Table 4: Blueprint of the Scientific Reasoning Test in Physics

Sl. No.	*Chapter*	*Inductive Reasoning (No. of Test items)*	*Deductive Reasoning (No. of Test items)*	*Analogical Reasoning (No. of Test items)*	*Eclectic Reasoning (No. of Test items)*	*Classification as Reasoning (No. of Test items)*	*Total*
1	Force and pressure	2	2	2	2	2	10
2	Friction	1	2	2	1	1	7
3	Sound	1	1	2	2	2	8
4	Chemical effects of electric current	2	2	1	1	1	7
5	Some natural phenomena	0	2	1	2	1	6
6	Light	2	0	1	1	2	6
7	Stars and the solar system	2	1	1	1	1	6
Total		**10**	**10**	**10**	**10**	**10**	**50**

The process of scoring the Scientific Reasoning Test in physics is shown in Table-5

Table-5: Scoring of the Scientific Reasoning Test in Physics

Sl. No.	ANSWER	MARKS
1.	Correct	1
2.	Incorrect	0

From the Table No.-5, it is clear that-

a) One mark is allotted for correct response

b) Zero is allotted for incorrect response

Instructions to be included in the Scientific Reasoning Test in physics for the students were decided in this step

ii. Preparation of the test:

The researcher constructed pool of items for the study. Items for constructing the test were collected through critical study of the available literature on Reasoning Test in physics from books, available research papers and consultation with experts. The reference books of science for Class-VIII were also used for this purpose. This helped the researcher in the preparation of the draft of the Scientific Reasoning Test in Physics. In the draft Scientific Reasoning Test in Physics, the researcher wrote a large number of items (95 test items) from which items for the final test were selected. The number of test items written from each chapter of physics from the science textbook of Class-VIII is shown in Table-6.

Table-6: Chapters and number of test items included in the Scientific Reasoning Test in Physics.

Sl. No.	Chapters from Science Textbook of Class-VIII	No. of test items
1	Force and pressure	19
2	Friction	13
3	Sound	11
4	Chemical effects of electric current	16
5	Some natural phenomena	10
6	Light	10
7	Stars and the solar system	16
Total		**95**

After writing the test items, the researcher consulted with the supervisor and subject experts to check the content coverage according to the blue print or any modification required in the items of the test. The necessary modifications were done on a few test items as per the suggestions given by the experts.The blueprint of the test items of the Scientific Reasoning Test in Physics of the Class-VIII students is shown in Table-7.

Table 7: Distribution of test items of the Scientific Reasoning Test in Physics

Sl. No.	*Chapter*	*Inductive Reasoning (Sl. No. of test items)*	*Deductive Reasoning (Sl. No. of test items)*	*Analogical Reasoning (Sl. No. of test items)*	*Eclectic Reasoning (Sl. No. of test items)*	*Classification as Reasoning (Sl. No. of test items)*	*Total*
1	Force and pressure	82,87,91, 92,	1,2,3,4	21,24,29,30,36	41,42,43,60	61,73	19
2	Friction	88,93,94	5,6,7,8	22,31	56,57	63,74	13
3	Sound	83	9,10	23,32,35	44,45,46,	62,75	11
4	Chemical effects of electric current	84,86,89	11,12,13,14	25,33	47,48,50	64,65,66,76	16
5	Some natural phenomena	---------	15,16,17	26,34	53,54,55	67,77	10
6	Light	81,85	----------	27,37,38,39	49,51,52	78	10
7	Stars and the solar system	90,95	18,19,20	28,40	58,59	68,69,70,71,72,79,80	16
Total		**15**	**20**	**20**	**20**	**20**	**95**

The necessary instructions for the respondents were prepared and added to the front page of the test of Scientific Reasoning in Physics as shown in Table-8.

Table 8: Instructions given on the front page of the Scientific Reasoning Test in Physics

General Instruction:

1. This test contains 95 questions.

2. Try to answer all the questions.

3. Find out the most appropriate alternatives from question no.1 to question no. 95.

4. For every question in the test, four alternatives are given. Give your response by filling the circle with only one option (a, b, c, or d) in the answer sheet provided**.**

5. Circles must be filled, otherwise it will not be considered.

6. Each question carries 1 mark. There is no negative marking for wrong answer.

7. You can select only one option otherwise it will be treated as incorrect.

8. Use a black or blue ink ball pen.

9. A question booklet will be provided five minutes before the response sheet.

iii. Item Analysis:

Seven schools of Charaideo district were selected using purposive sampling technique, for the try-out of the draft Scientific Reasoning Test in Physics. The test was administered to a group comprising of 303 students studying in Class-VIII in these selected schools. The responses of the students were collected and scored for item analysis.

After scoring of the test, the researcher arranged the scores of all the sampled 303 students in descending order, i.e., from the highest to the lowest score. Based on the total score, the upper 27% of the examinees from the top scorer and the lower 27% of the examinees from the bottom scorer were separated to form two separate groups namely, the high group and the low group.

Then, the discrimination index (V) and difficulty index (P) value for each test item were calculated to find out whether the discrimination index and difficulty index of a particular test item was significant or not. The discrimination index (V) of each item was calculated using the formula:

$$V = \frac{R_U}{N_U} - \frac{R_L}{N_L}$$

Where 'V' represents the discrimination index of each item, 'R_U' represents the number of examinees giving responses correctly in the upper group, 'R_L' represents the number of examinees giving the responses correctly in the lower group, 'N_U' represents the number of examinees in the upper group and 'N_L' represents the number of examinees in the lower group. Items with a discrimination index of more than 0.36 (Ebel and Frisbie 1991) were selected for the final test.

The formula used for determining the difficulty index of each item was:

$$P = \frac{R_U + R_L}{N_U + N_L}$$

Where 'P' represents the difficulty index of each item, 'R_U' represents the number of examinees giving responses correctly in the upper group, 'R_L' represents the number of examinees giving the responses correctly in the lower group, 'N_U' represents the number of examinees in the upper group and 'N_L' represents the number of examinees in the lower group. Items with a difficulty index between 0.36 to 0.70 (Ebel and Frisbie 1991) were selected for the final test. Out of 95 test items, 50 test items had significant discrimination index and difficulty index. The distribution of the test items having satisfactory discrimination index and difficulty index are shown in Table-9.

Table-9: Distribution of the test items having satisfactory discrimination index and difficulty index

Sl. No.	*Chapter*	*Dimension*					*Total No. of test-items*
		Inductive Reasoning (Sl. No. of test items)	*Deductive Reasoning (Sl. No. of test items)*	*Analogical Reasoning (Sl. No. of test items)*	*Eclectic Reasoning (Sl. No. of test items))*	*Classification as Reasoning Sl. No. of test items)*	
1	Force and pressure	82,92	1,3,4	21,29,30,36	41,43,60	61,73	14
2	Friction	88,94	7	22	57	63	7
3	Sound	-------	9,10	23,35	44,45	62,75	8
4	Chemical effects of electric current	84,86,89	12,14	25	47,48	----------	8
5	Some natural phenomena	---------	16,17	----------	53	77	4
6	Light	81,85	----------	27	52	-------	3
7	Stars and the solar system	95	----------	28	----------	68,71,72,80	6
	Total	**10**	**10**	**10**	**10**	**10**	**50**

The researcher decided to include all the 50 test items s per the blue print of the Scientific Reasoning Test in physics having a satisfactory discrimination index and difficulty index for the final draft of the Scientific Reasoning Test in Physics for the Class-VIII students. The distribution of the 50 test items in each dimension for the final draft of the Scientific Reasoning Test in Physics for the Class-VIII students is shown in Table-10.

Table 10: Dimension wise test items with their sl.no.(s) of the final draft of the Scientific Reasoning Test in Physics.

Dimension	*Sl. No. of test items*	*Total No. of test-items*
Inductive Reasoning	81,82,84,85,86,88, 89,92,94,95	10
Deductive Reasoning	1,3,4,7,9,10,12,14,16,17	10
Analogical Reasoning	21,22,23, 25,27,28,29,30,35,36	10
Eclectic Reasoning	41,43,44,45,47,48, 52,53, 57,60	10
Classification as Reasoning	61,62,63, 68, 71,72, 73,75,77,80	10
Total		**50**

- **Time Limit for the Scientific Reasoning Test in Physics:**

The Scientific Reasoning Test in Physics was first administered on 20 students studying in Class-VIII to determine the time limit of the test. The average time taken by the students to complete the Scientific Reasoning Test in Physics was 1 hour. Therefore, 1 hour has been fixed as the time limit for the Scientific Reasoning test in Physics.

iv. Standardization of the test:

- **Validity of the test**

To determine the content validity, the draft Scientific Reasoning Test was sent to a number of experts to check the coverage of contents and also check whether the blue print covers all the contents. Based on their suggestions necessary modifications were done in preparing the different test items of the test.

- **Reliability of the test**

The Test-Retest technique was used to estimate the reliability of the Scientific Reasoning Test in Physics. To test the reliability, the Scientific Reasoning Test in Physics was administered twice to a group comprising of 401 students studying in Class-VIII in the selected schools. Two sets of scores were obtained from these tests. Then Pearson Product Moment Correlation was used to calculate the co-efficient of reliability. The co-efficient of reliability of the English version of the test was found as 0.73. The co-efficient of reliability of the Assamese-translated version of the test was found as 0.69. Again, when the scores of the English version and the Assamese translated version of the tests were calculated together, then the co-efficient of reliability of the test was found as 0.83.

RESULTS AND DISCUSSION

The discussion is based on the main findings of the research questions. To ensure the quality of the test, evidence of validity and reliability are required (Kimberlin and Winterstein 2008). A test is said to be valid if it is capable of retaining what is being tested (Facione et al. 2000). For the present study, the researcher used content validity. By analyzing the contents of each test item individually as well as together, the content validity was estimated. This method is used for measuring educational performance and proficiency (Singh 2015).To ensure the content validity of the Scientific Reasoning test in Physics expert judgement was employed.

The reliability of a test refers to the consistency of the score or measurement which is reflected in the reproducibility of the scores (Singh 2015). Reliability is the degree to which a measurement instrument produces consistent results when tested and re-tested as well as the degree to which a test is internally consistent.

The Test-Retest technique for determining reliability has been considered by the researcher to be suitable for the study. In this technique, a test is administered twice to the same group under the same conditions. The reliability coefficient can be estimated by correlating the two sets of scores from the same test. Pearson Product Moment correlation is used to estimate the reliability of the tests. The value of the reliability coefficient should be between 0.00 and 1.00 and should not have a negative value. The value of reliability coefficient 0.70 is considered satisfying (Fraenkel et al., 2012). The researcher used the Pearson Product Moment formula, to find the reliability coefficient of the test. Previous studies by Lawson (1978), Sundre (2008), Tobin and Capie (1981) and Zafitri et

al. (2019) have also employed test-retest technique to estimate the reliability of the Reasoning test in Science.The reliability coefficient of the English version of the test was found as 0.73. The reliability coefficient of the Assamese-translated version of the test was found as 0.69. Again, when the scores of the English version and the Assamese translated version of the tests were calculated together, then the reliability coefficient of the test was found as 0.83. In comparison, Lawson (1978) reported reliability co-efficient 0.85, Sundre (2008) reported reliability co-efficient 0.71, Tobin and Capie (1981) reported reliability co-efficient 0.85, Zafitri et al. (2019) reported reliability co-efficient 0.83 and Umuoighoro et al. (2025) reported reliability coefficient of the mathematics achievement test is 0.96.

CONCLUSION

This study has found out that this Scientific Reasoning test has a reliability of 0.83 which is nearby equivalent to the above reported studies. The items in the Scientific Reasoning test were selected through the item analysis. Their discrimination index (V) and difficulty index (P) were computed. Items with a discrimination index of more than 0.36 (Ebel and Frisbie, 1991) were kept for the calculation of reliability. Items with a difficulty index between 0.36 to 0.70 were kept for the calculation of reliability. Out of 95 test items, 50 test items had significant discrimination index and difficulty index. All items in the instrument are within the range of 0.36 and 0.70 making them very appropriate, suitable and effective.

Conclusively, the Scientific Reasoning test constructed by the researcher has the test items which are suitable and appropriate in terms of difficulty and discrimination indices and also the reliability and the validity were found satisfactory.

RECOMMENDATIONS

The study provides some implications and recommendations for teachers, administrators and policymakers. The constructed test helps in understanding how the language of instruction affects in the Scientific Reasoning ability in vernacular medium. As the test mainly focus into the dimensions of inductive, deductive, analogical, eclectic, classification Reasoning. Therefore, the study can give a way to the curriculum designer and teachers that on which reasoning type the students find harder, and guiding them to how to teach them and design such type of curriculum for them. The construct test instrument for assessing scientific reasoning specifically in Physics for Class VIII students in the Indian context, which can be used by other researchers and educators. There is a few literatures on scientific reasoning tests in regional languages in India. Therefore, the study fills this gap, providing evidence of validity and reliability in Assamese vernacular medium, which may later generalize to other regional languages.

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