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Research Article

CONSTRUCTION OF PHYSICS ACHIEVEMENT TEST FOR CLASS X CBSE STUDENTS IN SIKKIM

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Abstract

The field of science education in India is presently undergoing a notable change. With the National Education Policy (NEP) 2020 and PARAKH, science education is moving away from rote memorization toward competency-based frameworks. Central to this transformation is the development of scientifically rigorous achievement tests that can objectively measure conceptual understanding, critical thinking and scientific reasoning in the physical world. The present study aimed at constructing and standardizing a Physics Achievement Test (PAT) for Class X CBSE students in Sikkim. The study adopted a quantitative descriptive design. The achievement test was based on four NCERT Physics chapters: Light, Human Eye, Electricity, and Magnetic Effects. A preliminary pool of 77 items were subjected to expert validation and the Item Content Validity Index (I-CVI) was calculated. A pilot study (n=56) enabled the analysis of items through Difficulty Index (DI), Discrimination Index (D), and Point-Biserial Correlation (rpb). The final standardized PAT consists of 46 items. The test had a KR-20 reliability coefficient of 0.90, indicating high internal consistency. Norms were developed (n=260) by using z-scores and percentile ranks. The PAT is a reliable tool for classifying students' physics achievement into five distinct levels, ranging from "Very High" to "Very Low". The PAT is an objective measure of learning outcomes. This standardized tool helps educators in finding achievement gaps and identify students who need targeted intervention.

Keywords: Achievement test, Standardized test, Sikkim, CBSE, Physics.

INTRODUCTION

Education is recognized as one of the most important instruments for national development, social transformation, economic growth, and individual empowerment. In contemporary society, education extends beyond the mere acquisition of knowledge. It seeks to develop skills, attitudes, values, scientific temper, creativity, and the ability to apply learning in real-life situations (Ministry of Human Resource and Development, 2020). Among the various disciplines taught in schools, science occupies a significant position because it enables learners to understand the natural and physical world through systematic observation, experimentation, reasoning, and evidence-based inquiry. Science education contributes to the development of cognitive, affective and psychomotor competencies. The National Education Policy, 2020, emphasizes that science education should promote inquiry-based learning, experiential learning, conceptual understanding, scientific reasoning, analytical thinking and problem-solving abilities (Ministry of Human Resource and Development, 2020). Within the domain of science education, Physics occupies a unique and important position. Physics seeks to explain the fundamental principles governing matter, energy, force, motion, electricity, light and other natural phenomena(National Steering Committee for National Curriculum Frameworks, 2023). Assessing and measuring the attainment of objectives is a crucial part of education. According to Baybayan and Lacia (2024), academic achievement refers to the advancement made toward acquiring educational skills, resources and information. Consequently, achievement in Physics serves as an important indicator of a student's scientific understanding and readiness for higher studies.

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Ebel and Frisbie (1991) emphasized that scientifically developed assessment tools yield reliable, objective, and meaningful information about student learning. One of the most widely used tools for educational assessment is the achievement test.

Achievement Test

Achievement tests are designed to measure the knowledge, understanding, skills and competencies acquired by students after a period of instruction in a particular subject area. These tests are generally aligned with curriculum objectives, content areas and expected learning outcomes (Attakumah, 2020). In science education, achievement tests are particularly important because they assess not only factual knowledge but also conceptual understanding, scientific reasoning, problem solving ability and the application of scientific principles. An achievement test is used to measure how much a student has learned in a subject after teaching has taken place. It does not measure intelligence or hidden ability. Instead, it measures current learning in a specific area (Attakumah, 2020). According to Gronlund and Linn (1990), an achievement test is a systematic procedure for determining the amount a student has learned through instruction in a particular subject area. Whereas Ebel and Frisbie (1991) defined an achievement test as a test designed to measure a student's present level of knowledge, understanding or skill in a specific area developed through learning and instruction. The National Education Policy, 2020, and the establishment of PARAKH (Performance Assessment, Review and Analysis of Knowledge for Holistic Development) have emphasized the need for valid, reliable and standardized assessment practices. This highlights the importance of scientifically developed achievement tests that can objectively measure student's learning outcomes and provide meaningful interpretations of performance.

Research Objectives

- To construct a blueprint for the Physics syllabus of Class 10 CBSE Board.
- To develop test items Based on the content of the Class 10 CBSE Physics textbook.
- To standardize the Physics Achievement Test for students of Class 10 CBSE Board.
- To establish norms for the Physics Achievement Test for Class 10 CBSE Board students.

RESEARCH METHOD

The present study adopted a descriptive quantitative research design. The responses obtained from students were analysed using statistical techniques such as difficulty index, discrimination index, mean, standard deviation, and reliability coefficient. In the present study, the population consisted of all Class X students studying in CBSE-affiliated schools of Sikkim. A total of 5158 students appeared for the CBSE Class X examination during the academic session 2025–2026 from Sikkim (Gurung, 2026). For pilot testing, 56 students were randomly selected as sample from the population. For the final administration test for setting up norms, 260 students who have recently passed their class X CBSE board exam (session 2026-27) were randomly selected as the sample from different schools.

Construction of Physics Achievement Test

The Physics Achievement Test (PAT) was constructed systematically by following the principles and procedures of educational test construction suggested by Gronlund and Linn (1990).

Selection of Content

The content for the test was selected from four Physics chapters of the NCERT Class X science textbook, namely : Light-Reflection and Refraction, The Human Eye and the Colourful World, Electricity and Magnetic Effects of Electric Current. These chapters are fundamental for developing student's conceptual understanding of physical phenomena and their abilityto apply scientific principles in everyday life (NCERT, 2020).

Identification of Learning Objectives

The instructional objectives were identified to ensure that the test measured different levels of learning. The objectives were selected based on Bloom's Taxonomy of Educational Objectives, which classifies learning outcomes into hierarchical cognitive levels and provides a framework for assessing student's knowledge, understanding, application, and higher-order thinking skills (Bloom *et al.,* 1956).

Weightage to Content

The weightage has been systematically assigned to each chapter on the basis of the extent of content coverage, the total marks distribution under CBSE guidance in formulating the blueprint of the test. In addition, the conceptual importance of each unit and the prescribed learning outcomes were considered. This careful process ensured equal representation of all content domains, and increased the overall content validity of the achievement test.

Table 1. Distribution of items based on each selected chapter from the class X NCERT textbook

Sl. No.	Chapters	No. of Items	Percentage %
1	Light – Reflection and Refraction	25	32.4%
2	The Human Eye and the Colourful World.	12	15.5%
3	Electricity	20	25.9%
4	Magnetic Effects of Electric Current.	20	25.9%
Total		77	100%

Weightage to Objectives

Weightage was distributed among instructional objectives to ensure balanced measurement of knowledge, understanding, application, and skills. Greater emphasis was given to understanding and application as Physics learning requires conceptual clarity and practical application of principles.

Table 2. Distribution of items according to instructional objectives

Sl. No	Objectives	No. of Items	Percentage (%)
1.	Knowledge	31	40%
2.	Understanding	27	35%
3.	Applications	14	18%
4.	Skills	5	7%
Total		77	100%

Construction of Blueprint

A blueprint is a structured plan or table that outlines the distribution of content areas, learning objectives, types of questions, and weightage in a test; it serves as a framework for item construction and ensures content validity of the test (Gronlund & Linn, 1990). A blueprint was prepared to provide balanced representation of content areas, learning objectives, and weightage of marks.

Writing of Test Items

Based on the blueprint, researchers developed 77preliminary multiple-choice objective-types by careful and detailed study. In preparing these items clarity of language, scientific accuracy, relevance to the content, and appropriateness was checked carefully.

Table 3. Blueprint for Constructing Physics Achievement Test (PAT)

Sl No	Learning Outcomes Chapter	Knowledge	Understanding	Applications	Skills	Total
1.	Light – Reflection and Refraction	10	9	4	2	25
2.	The Human Eye and the Colourful World	5	4	2	1	12
3.	Electricity	8	7	4	1	20
4.	Magnetic Effects of Electric Current	8	7	4	1	20
Total		31	27	14	5	77

Establishing Validity

Content validity refers to the extent to which a test measures what it intends to measure (Henning, 1987). The preliminary draft of the test was submitted to three experienced Physics teachers for expert review. The experts examined the items in terms of two dimensions with rating scale of 1-4.

Relevance: Alignment with content, based on specific learning outcomes and mental ability of the learners. Where Experts were suggested to rate each item based on the following

Clarity: Semantic Clarity and Option distinctiveness.

This study used the I-CVI (Item Content Validity Index) to establish the content validity of developed test items. Item content validity index (I-CVI) is the ratio of experts who agree that a particular item is relevant to the content domain being measured.

It is a quantitative measure of content validity at the item level and shows the extent of agreement of experts regarding the relevance of an individual test item (Polit & Beck, 2006). The items were evaluated on two dimensions, namely relevance and clarity. Expert rating was converted into binary (0 or 1) where 4 (highly relevant/clear) or 3 (Quite relevant/clear) items were considered valid and rated as "1". And for expert rating 2 (somewhat relevant/clear) or 1 (less relevant/clear) the items were considered invalid and further rated as "0".

The formula used to calculate ICVI was,

$$ICVI=n_e/N$$

I-CVI = Item Content Validity Index
n_e=Number of experts who rated the item based on relevance or clarity.
N = Total number of experts.

To evaluate the content validity of the test items in terms of relevance and clarity, the Item Content Validity Index for Relevance and the Item Content Validity Index for Clarity were calculated for each item based on expert ratings. The average I-CVI (Relevance and clarity) was computed to obtain the overall content validity score of each item. Items obtaining an average content validity score of 1 were considered valid and retained for inclusion in the Physics Achievement Test, whereas items scoring below this criterion were revised or discarded.

Table 4. The number of experts and its implication on the acceptable CVI values

No. of experts	Acceptable CVI values	Source of recommendation
2	At least 0.8	Davis (1992)
3 to 5	Should be 1	Polit & Beck (2006), Polit et al., (2007)
At least 6	0.83	Polit & Beck (2006), Polit et al., (2007)
6- 8	0.83	Lynn (1986)

The analysis revealed out of the 77 items, 65 items obtained an average I-CVI value of 1 and were therefore considered valid for inclusion in the Physics Achievement Test. However, 12 items obtained average I-CVI values below 1 and were identified as requiring revision or elimination.

Preliminary Try-out

The preliminary form of the Physics Achievement Test, consisting of 65 multiple-choice items, was administered to a randomly selected sample of 56 Class X students who had recently completed the selected Physics chapters and appeared for the CBSE Board Examination. The pre tryout consisted of only the reviewed items with I-CVI of 1. The responses obtained from the students were scored using the prepared scoring key and subsequently analysed to evaluate the quality and effectiveness of the test items.

Item Analysis

The responses obtained from the pilot study were analysed to determine the difficulty index and discrimination index of each item. Items with acceptable values were retained, while unsuitable items were revised or discarded.

Difficulty index

Item difficulty refers to the proportion or percentage of students who answer a particular test item correctly (Rezigalla, 2022). The difficulty index indicates the proportion of students who answered an item correctly.

The formula used was:

$$DI = R/N \times 100$$

Where, DI = Difficulty Index
R = Number of students answering correctly
N = Total number of students

Finding the difficulty index is crucial to test the quality of the items.

The Difficulty Index was calculated to determine the proportion of students who answered each item correctly. It indicates the relative ease or difficulty of a test item and assists in identifying items that are too easy, too difficult or of moderate difficulty.

Table 5. Difficulty Index for Individual Test Items

Item No.	Difficulty Index (DI)	Item No.	Difficulty Index (DI)	Item No	Difficulty Index (DI)
Q1	0.69	Q23	0.68	Q46	0.43
Q2	0.7	Q24	0.78	Q47	0.63
Q3	0.46	Q25	0.43	Q48	0.57
Q4	0.59	Q26	0.5	Q49	0.57
Q5	0.74	Q27	0.56	Q50	0.57
Q6	0.66	Q28	0.61	Q51	0.66
Q7	0.43	Q29	0.5	Q52	0.46
Q8	0.44	Q30	0.67	Q53	0.72
Q9	0.26	Q31	0.61	Q54	0.66
Q10	0.48	Q32	0.61	Q55	0.56
Q11	0.41	Q33	0.63	Q56	0.41
Q12	0.56	Q34	0.52	Q57	0.74
Q13	0.5	Q35	0.54	Q58	0.43
Q14	0.15	Q36	0.48	Q59	0.66
Q15	0.41	Q37	0.26	Q60	0.52
Q16	0.41	Q38	0.78	Q61	0.52
Q17	0.33	Q39	0.59	Q62	0.61
Q18	0.59	Q40	0.5	Q63	0.41
Q19	0.57	Q41	0.37	Q64	0.52
Q20	0.46	Q42	0.52	Q65	0.37
Q21	0.54	Q43	0.52		
Q22	0.51	Q44	0.46		

Table 6. Classification of items based on Difficulty Index (DI) based on (Joshi & Arya, 2005)

Difficulty Index (DI)	Level	Item no.
> 0.75	Easy	Q24, Q38 & Q57
0.25–0.75	Average	Q1,Q2,Q3, Q4, Q5, Q6, Q7, Q8, Q10, Q11, Q12, Q13, Q15, Q16, Q17, Q18, Q19, Q20, Q21, Q22, Q23, Q25, Q26, Q27, Q28, Q29, Q30, Q31, Q32, Q33, Q34, Q35, Q36, Q39, Q40, Q41, Q42, Q43, Q44, Q45, Q46, Q47, Q48, Q49, Q50, Q51, Q52, Q53, Q54, Q55, Q56, Q58, Q59, Q60, Q61, Q62, Q63, Q64, Q65
< 0.25	Difficult	Q9, Q14 & Q37

Items falling within the average difficulty range (59 items) were considered most suitable for inclusion in the final form of the Physics Achievement Test because they possess better discriminatory power. Therefore, items identified as easy (3 items) or difficult (3 items) were excluded from the final test.

Discrimination Index

The discrimination index indicates the ability of an item to differentiate between high achieving and low achieving students. Item discrimination refers to the ability of a test item to differentiate between high-achieving and low-achieving students (Christian *et al.,* 2017).

The upper 27 percent and lower 27 percent groups were formed for item analysis(Kelly, 1939).

The formula used was:

$D = (U - L) / (N/2)$

Where, D = Discrimination Index

U = Number of students answering correctly in the upper group
L = Number of students answering correctly in the lower group
N = Number of students in both groups

Table 7. Discrimination Index of Individual Test Items

Item No.	Discrimination Index (D)	Item No.	Discrimination Index (D)	Item No.	Discrimination Index (D)
Q1	0.53	Q23	0.33	Q46	0.33
Q2	0.53	Q24	0.2	Q47	0.6
Q3	0.33	Q25	0.73	Q48	0.53
Q4	0.4	Q26	0.4	Q49	0.33
Q5	0.33	Q27	0.4	Q50	0.47
Q6	0.53	Q28	0.53	Q51	0.53
Q7	0.4	Q29	0.53	Q52	0.27
Q8	0.47	Q30	0.8	Q53	0.33
Q9	0.27	Q31	0.67	Q54	0.47
Q10	0.27	Q32	0.8	Q55	0.47
Q11	0.4	Q33	0.47	Q56	0.67
Q12	0.2	Q34	0.4	Q57	0.2
Q13	0.53	Q35	0.67	Q58	0
Q14	0.13	Q36	0.2	Q59	0.53
Q15	0.6	Q37	0.33	Q60	0.47
Q16	0	Q38	0.33	Q61	0.53
Q17	0.2	Q39	0.47	Q62	0.6
Q18	0.67	Q40	0.67	Q63	0.53
Q19	0.53	Q41	0.2	Q64	0.4
Q20	0.47	Q42	0.47	Q65	0.53
Q21	0.6	Q43	0.47		
Q22	0.6	Q44	0.2		

Table 8. Classification of test items based on discriminating power based on (Ebel & Frisbie, 1991)

Discrimination Index (D)	Level	Item no.
≤ 0.2	Very poor	Q12, Q14, Q16, Q17, Q24, Q36, Q41, Q44, Q57 & Q58
0.21- 1.0	Acceptable items	Q1,Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q11, Q13, Q15, Q18, Q19, Q20, Q21, Q22, Q23, Q25, Q26, Q27, Q28, Q29, Q30, Q31, Q32, Q33, Q34, Q35, Q37, Q38, Q39, Q40, Q42, Q43, Q45, Q46, Q47, Q48, Q49, Q50, Q51, Q52, Q53, Q54, Q55, Q56, Q59, Q60, Q61, Q62, Q63, Q64, Q65

According to the obtained Discrimination Index values, 10 items were categorized as very poor items because their discrimination values were less than or equal to 0.20. These items were considered ineffective in differentiating between high-achieving and low-achieving students and were therefore rejected. The remaining 55 items obtained discrimination values greater than 0.20 and were classified as acceptable items.

Point-Biserial Correlation Coefficients

The Point-Biserial Correlation Coefficient (rpb) was calculated to determine the relationship between a student's performance on an individual test item and their overall performance on the Physics Achievement Test. Since the test items were scored dichotomously (1 for correct and 0 for incorrect), the point-biserial coefficient was considered an appropriate statistical measure. It helps identify whether students obtaining high total test scores also tend to answer a particular item correctly.

Table 9. Correlational coefficient of Individual Test Items

Item No.	Correlational Coefficient (rpb)	Item No.	Correlational Coefficient (rpb)	Item No.	Correlational Coefficient (rpb)
Q1	0.42	Q23	0.27	Q45	0.34
Q2	0.45	Q24	0.26	Q46	0.28
Q3	0.33	Q25	0.49	Q47	0.49
Q4	0.35	Q26	0.37	Q48	0.43
Q5	0.29	Q27	0.31	Q49	0.31
Q6	0.54	Q28	0.47	Q50	0.45
Q7	0.31	Q29	0.42	Q51	0.47
Q8	0.53	Q30	0.61	Q52	0.22
Q9	0.34	Q31	0.51	Q53	0.25
Q10	0.32	Q32	0.6	Q54	0.42
Q11	0.43	Q33	0.31	Q55	0.36
Q12	0.26	Q34	0.59	Q56	0.47
Q13	0.39	Q35	0.5	Q57	0.17
Q14	0.25	Q36	0.23	Q58	0.15
Q15	0.42	Q37	0.23	Q59	0.36
Q16	0.12	Q38	0.34	Q60	0.39
Q17	0.23	Q39	0.41	Q61	0.36
Q18	0.53	Q40	0.5	Q62	0.44
Q19	0.45	Q41	0.26	Q63	0.49
Q20	0.46	Q42	0.4	Q64	0.24
Q21	0.43	Q43	0.34	Q65	0.47
Q22	0.36	Q44	0.28		

Higher positive point-biserial values suggest that students obtaining high total scores also tend to answer the item correctly, indicating that the item functions effectively and is consistent with the overall test. Conversely, low or negative values indicate weak item performance and suggest that the item may not adequately measure the intended learning outcomes.

Table 10. Classification of test item-based on correlation coefficient (rpb) based on (Jackson, 2016)

Correlation Coefficient (rpb)	Level	Item No.
<0.30	Very poor	Q5, Q12, Q14, Q16, Q17, Q23, Q24, Q36, Q41, Q44, Q46, Q52, Q53, Q57, Q58 & Q64
0.30- 1.0	Acceptable items	Q1,Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q11, Q13, Q15, Q18, Q19, Q20, Q21, Q22, Q25, Q26, Q27, Q28, Q29, Q30, Q31, Q32, Q33, Q34, Q35, Q37, Q38, Q39, Q40, Q42, Q43, Q45, Q47, Q48, Q49, Q50, Q51, Q54, Q55, Q56, Q59, Q60, Q61, Q62, Q63 & Q65.

The analysis revealed that 16 items obtained point-biserial coefficients below 0.30 and were therefore classified as very poor items. These items showed weak relationships with the overall test scores and were considered unsuitable for inclusion in the final form of the Physics Achievement Test. The remaining 49 items obtained point-biserial coefficients ranging from 0.30 to 1.00 and were classified as acceptable items.

Establishing Reliability

According to Ebel and Frisbie (1991), reliability indicates the extent to which test scores are free from measurement errors and yield consistent results when administered under similar conditions. Reliability is an essential characteristic of a standardized achievement test because it ensures that the obtained scores accurately reflect student's achievement levels. The reliability of the Physics Achievement Test was estimated using the Kuder–Richardson Formula 20 (KR–20) because the test consisted of objective-type multiple-choice items with one correct answer and three incorrect answers.

The KR–20 formula is as follows:

$$KR\text{-}20 = k/(k-1)(1-\sigma 2\sum pq)$$

Where:
KR–20 = Reliability coefficient
k = Total number of test items
p = Proportion of students answering an item correctly
q = Proportion of students answering an item incorrectly
σ^2 = Variance of the total test scores

The KR–20 method is widely used for estimating the internal consistency of tests containing dichotomously scored items. The reliability coefficient of the Physics Achievement Test was found to be 0.90. The obtained reliability coefficient was 0.90, indicating a very high level of internal consistency among the test items. This suggests that the Physics Achievement Test is a reliable instrument for measuring the achievement of Class X CBSE students in Physics.

Preparation of Final Form of Physics Achievement Test (PAT)

The final test consisted of selected items that possessed acceptable validity, reliability, difficulty level, and discrimination power. After item analysis, unsuitable items were removed. The final form of the Physics Achievement Test consisted of 46 multiple-choice items after removing 19 items which were unsatisfactory.

Administration of final form of physics achievement test

After establishing the validity and reliability of the Physics Achievement Test, the final form of the test was administered to the selected sample of 260 students who had recently completed the CBSE Class 10 Board Examination (2025–2026). The students were informed about the purpose of the study and were given clear instructions on how to respond to the test items.

Table 11. Final Test Items

Criterion	Number of Items
Total items in preliminary draft	77
Items rejected based on I-CVI	12
Items rejected based on Difficulty Index (DI)	6
Items rejected based on Discrimination Index (D ≤ 0.20)	10
Items rejected based on Point-Biserial Correlation (rpb< 0.30)	16
Total items rejected	31
Final items retained for the Physics Achievement Test	46
Reliability Coefficient (KR-20)	0.90

Adequate time was provided for completing the test, and all students were tested under similar conditions to ensure fairness, consistency, and objectivity. Upon completion of the test, the answer sheets were collected immediately and scored according to the prepared scoring key.

Scoring

The process of assigning numerical values to participant's responses in a test is called as scoring. The study adopted dichotomous scoring where in each correct response was assigned numerical value '1' and incorrect response was assigned numerical value '0'. The total number of correct responses obtained by a student constitutes the raw score. These raw scores represented the actual performance of students on the Physics Achievement Test and formed the basis for subsequent statistical analyses.

Development of Norms for Physics Achievement Test

Norms provide a basis for interpreting test scores by comparing an individual's performance with that of a representative reference group. According to Garrett (1947), norms serve as standards against which individual scores can be evaluated and interpreted meaningfully. Since raw achievement test scores don't reflect a student's relative position within a group, they typically have little relevance when examined separately. Therefore, in order to enable meaningful performance interpretation, raw scores are transformed into standard values like percentile ranks and z-score. The developed norms offer a standard framework for categorizing students according to their achievement levels.

Table 12. Norms for Interpretations of PAT based on percentile (n=260)

Percentile Range	Raw Score	Achievement Level
P90 and above	36 and above	Very High
P70 – P89	30 to 35	High
P30 – P69	21 to 29	Average
P10 – P29	15 to 28	Low
Below P10	Below 15	Very Low

Percentile ranks serve as a framework for comparing an individual's performance with that of other members of the group by showing the proportion of members of the standardized group that scored at or below a specific score (Anastasi & Urbina, 1997). Students with raw score of 36 and above fall into the 90thpercentile and above range, placing them in the Very High achievement level, while those scoring between 30 and 35 sit within the 70th to 89thpercentiles, categorizing them as High achievers. The typical performance baseline is captured in the Average achievement level, which spans the 30thto 69thpercentiles and corresponds to raw scores from 21 to 29. Conversely, low achievers are flagged in the Low achievement level for raw scores between 15 and 28 (representing the 10thto 29thpercentiles) and the Very Low achievement level covers any student scoring below 15 points, placing them in the bottom 10thof test-takers and highlighting a critical need for targeted academic intervention.

Table 13. Norms for Interpretations of PAT based on z- score (n= 260)

Sl. No.	Range of z-Score	Obtained Score	Achievement Level
1	+1.26 and above	Above 35	Very Good
2	0.51 to +1.25	25 to 29	Above Average
3	-0.50 to +0.50	21 to 24	Average
4	-0.51 to -1.25	15 to 20	Below Average
5	-1.26 and below	Below 15	Very Poor

Based on z-scores there are five distinct achievement levels. Students who score above 35 and a z-score of +1.26 and above, are placed in the very good achievement level, while those scoring between 25 and 29 points fall within a z-score range of 0.51 to +1.25, classifying them as above average. The average level, captures scores from 21 to 24 and corresponds to a z-score range of -0.50 to +0.50. Conversely, students scoring between 15 and 20 (z-score range of -0.51 to -1.25), are grouped into the below average category. Meanwhile any score below 15 (z-score of -1.26 and below), is categorized as very poor, highlighting a need for academic support. The norms provide a meaningful framework for interpreting individual test scores by indicating the relative standing of students within the standardization group.

Conclusion

The Physics Achievement Test (PAT) for Class X CBSE students was developed through a systematic process involving content selection, preparation of a blueprint, item writing, expert validation, pilot testing, item analysis, and reliability estimation. Content validity was established through expert review, and item analysis was conducted using the Difficulty Index, Discrimination Index, and Point-Biserial Correlation Coefficient. The reliability of the test was found to be 0.90 using the KR-20 formula, indicating high reliability. Based on the results of item analysis, the final form of the test consisting of 46 items was prepared. The test was then administered for standardization through both z-score norms and percentile norms to develop and facilitate the interpretation. The different achievement level helps teachers, researchers and educational administrators understand student's achievement in Physics and evaluate the extent to which the instructional objectives have been attained. The developed norms also facilitate objective comparison of student's performance and support educational decision-making regarding learning outcomes and academic progress.

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