

Development and Validation of Achievement Test on Mathematics Among IX Students in Kerala State Board

SREELAKSHMI P

Ph.D. Research Scholar, School of Education,
(VISTAS) VELs University, Chennai,
email – sreelu37@gmail.com

Dr. S. POONGUZHALI, Ph.D

Research Supervisor
Assistant Professor in Education
School of Education,
Vels (VISTAS) University, Chennai

Abstract

The aim of the study is the development and validation of an achievement test specifically for assessing in mathematics achievement of IX standard students adhering to the Kerala state board curriculum. Focusing on three content units – Circle measures, Polynomials and Prisms. The test was developed through rigorous steps: blue printing, pilot testing, item analysis and expert validation. Initially, a 90- item multiple-choice test was constructed. Based on the difficulty and discrimination indexes derived from the item analysis, a total of 50 items was selected for inclusion in the final test draft. Demonstrating robust content and face validity the final test is designed as a reliable instrument for measuring learning outcomes across Bloom's cognitive domains. The study advances educational measurement by developing an empirically and psychometric validated, curriculum-specific assessment tool. This instrument offers significant utility, serving not only a reliable classroom aid for teachers but also as a rigorous, standardized measure for future educational research.

KEY WORDS:

Mathematics Achievement-test, Item Analysis, IX Standard Mathematics.

***** INTRODUCTION:

The quality of an educational system is intrinsically linked to its assessment method. Given its role as the science, technology, engineering and critical thinking. Mathematics necessitates particularly rigorous evaluation. Achievement test are crucial instruments used to measure student's proficiency, their mastery of curriculum objectives and their grasp of key mathematical concepts. The essential feedback provided allows students, educators and policymakers to enable targeted instruction and make informed curricular decisions. This article thoroughly documents the comprehensive, systematic procedure used to create and validate a specialized Mathematics Achievement test. The resulting instrument, which was built upon the strict tenets of test construction possesses robust empirical characteristics including high validity and reliability, in addition to being content-relevant and challenging. The test is aligned with Bloom's Taxonomy specifically assessing the cognitive domain of knowledge, understanding, application and analysis.

The selected content areas for test construction are:

- Polynomials
- Circle measures
- Prisms

The test development involved comprehensive procedures including blueprint preparation, pilot testing, and psychometric validation to ensure content coverage and technical quality.

METHODOLOGY:

Tool Construction: A preliminary 90-item multiple-choice test was developed based on the Kerala State Board curriculum and learning objectives. The blueprint ensured balanced representation across content areas and cognitive domains:

Table – 1

WEIGHTAGE GIVEN

TO THE CONTENT OF THE PRELIMINARY DRAFT OF THE ACHIEVEMENT TESTL

Content	Total (Marks)
Polynomials	26
Circle Measures	32
Prisms	32
Total	90

Table – 2

PRELIMINARY DRAFT OF THE CRITERION TEST TOOL (BLOOM'S TAXANOMY)

OBJECTIVES	MARKS
Knowledge	15
Understanding	40
Application	20
Analysis	15
Total	90

Table – 3

BLUE PRINT - TWO DIMENTIONAL CHART OF THE PRELIMINARY DRAFTY OF THE CRT TEST +-+

Content	Knowledge	Understanding	Application	Analysis	Total (Marks)
Polynomials	5 (1)	11(1)	7 (1)	3(1)	26(1)
Circles	5(1)	14(1)	7(1)	6(1)	32(1)
Prisms	5(1)	15 (1)	6(1)	6(1)	32 (1)
Total	15(1)	40 (1)	20 (1)	15(1)	90 (1)

PILOT STUDY

The Initial Draft of the Achievement test Tool was prepared and featuring a total of 90 items. Learners were provided with specific instructions detailing time limit, the required response format and other procedural guidance. The 90-item

instrument was pilot-tested with a sample of 50 students from the 9th standard, followed by the computation of their results. Each item is presented in a multiple -choice format featuring one correct response and three distractors. A dichotomous score for each correct response was awarded one point and incorrect response received zero. Item analysis were performed using the 50 completed answer sheets.

ITEM ANALYSIS

The effectiveness of a test can be increased by the selection of items of suitable difficulty value and discrimination index. Item analysis included two different characteristics namely, ➤ Item difficulty and the

➤ Item discrimination.

Item difficulty refers to the percentage of students who answer the item correctly whereas the discrimination reflects the degree to which an item distinguishes between the High Scores and Low Scores. To select the good test items, a close analysis of all items was made. This made it possible for the elimination of certain items based on the results of the item analysis. The investigator selected items having difficulty value between 0.5 and 0.75 and discrimination index higher than 0.40. Accordingly, 50 items were selected from the 90 items. The total score of the achievement test of the final study was 50 marks.

Item NO	Discriminating Power (D.P)	Accepted/ Modified/Rejected	Difficulty Value (DV)	Accepted/ Modified/Rejected
Q1	.52	Accepted	.60	Accepted
Q2	.47	Accepted	.65	Accepted
Q3	.47	Accepted	.77	Accepted
Q4	.51	Accepted	.61	Accepted
Q5	.62	Accepted	.66	Accepted
Q6	.27	Rejected	.41	Rejected
Q7	.37	Rejected	.49	Rejected
Q8	.71	Accepted	.68	Accepted
Q9	.65	Accepted	.50	Accepted
Q10	.17	Rejected	.33	Rejected
Q11	.39	Rejected	.43	Rejected
Q12	.55	Accepted	.55	Accepted
Q13	.30	Rejected	.41	Rejected
Q14	.37	Rejected	.36	Rejected
Q15	.69	Accepted	.60	Accepted
Q16	.75	Accepted	.69	Accepted
Q17	.33	Rejected	.43	Rejected

Q18	.78	Accepted	.61	Accepted
Q19	.39	Rejected	.43	Rejected
Q20	.55	Accepted	.69	Accepted
Q21	.11	Rejected	.28	Rejected
Q22	.48	Accepted	.74	Accepted
Q23	.49	Accepted	.67	Accepted
Q24	.77	Accepted	.55	Accepted
Q25	.11	Rejected	.33	Rejected
Q26	.36	Rejected	.47	Rejected
Q27	.69	Accepted	.75	Accepted
Q28	.30	Rejected	.39	Rejected
Q29	.49	Accepted	.57	Accepted
Q30	.68	Accepted	.65	Accepted
Q31	.32	Rejected	.45	Rejected
Q32	.54	Accepted	.75	Accepted
Q33	.48	Accepted	.65	Accepted
Q34	.35	Rejected	.40	Rejected
Q35	.58	Accepted	.75	Accepted
Q36	.39	Rejected	.20	Rejected
Q37	.31	Rejected	.49	Rejected
Q38	.68	Accepted	.75	Accepted
Q39	.73	Accepted	.61	Accepted
Q40	.58	Accepted	.70	Accepted
Q41	.78	Accepted	.61	Accepted
Q42	.10	Rejected	.22	Rejected
Q43	.39	Rejected	.33	Rejected
Q44	.50	Accepted	.77	Accepted
Q45	.66	Accepted	.60	Accepted
Q46	.24	Rejected	.21	Rejected
Q47	.18	Rejected	.39	Rejected

Q48	.64	Accepted	.55	Accepted
Q49	.51	Accepted	.69	Accepted
Q50	.50	Accepted	.61	Accepted
Q51	.21	Rejected	.31	Rejected
Q52	.33	Rejected	.47	Rejected
Q53	.38	Rejected	.42	Rejected
Q54	.44	Accepted	.68	Accepted
Q55	.59	Accepted	.66	Accepted
Q56	.60	Accepted	.50	Accepted
Q57	.52	Accepted	.63	Accepted
Q58	.35	Rejected	.41	Rejected
Q59	.34	Rejected	.40	Rejected
Q60	.66	Accepted	.66	Accepted
Q61	.68	Accepted	.69	Accepted
Q62	.32	Rejected	.40	Rejected
Q63	.36	Rejected	.33	Rejected
Q64	.39	Rejected	.44	Rejected
Q65	.33	Rejected	.37	Rejected
Q66	.54	Accepted	.69	Accepted
Q67	.18	Rejected	.28	Rejected
Q68	.51	Accepted	.69	Accepted
Q69	.55	Accepted	.67	Accepted
Q70	.47	Accepted	.70	Accepted
Q71	.18	Rejected	.22	Rejected
Q72	.39	Rejected	.49	Rejected
Q73	.50	Accepted	.65	Accepted
Q74	.40	Accepted	.66	Accepted
Q75	.40	Accepted	.77	Accepted
Q76	.33	Rejected	.48	Rejected
Q77	.35	Rejected	.30	Rejected
Q78	.49	Accepted	.50	Accepted

Q79	.66	Accepted	.58	Accepted
Q80	.18	Rejected	.29	Rejected
Q81	.33	Rejected	.47	Rejected
Q82	.50	Accepted	.65	Accepted
Q83	.60	Accepted	.50	Accepted
Q84	.11	Rejected	.21	Rejected
Q85	.44	Accepted	.63	Accepted
Q86	.59	Accepted	.63	Accepted
Q87	.18	Rejected	.31	Rejected
Q88	.38	Rejected	.40	Rejected
Q89	.59	Accepted	.60	Accepted
Q90	.19	Rejected	.25	Rejected

Table-4

RELIABILITY AND VALIDITY PROCESS OF ACHIEVEMENT TEST

The test items were evaluated by 50 ninth standard Students Kozhikode District in Kerala Feedback was solicited on the following aspects:

- Alignment with learning outcomes and the syllabus
- Clarity of language and expression
- Clarity of content
- The necessity of each item

EDUCATIONAL SIGNIFICANCE

- Curriculum Relevance: Specifically tailored to the Kerala State Board IX standard syllabus, this tool ensures high contextual relevance and strict adherence to mandated learning objectives.
- Instructional Impact: The instrument facilitates formative assessment, empowering educators to diagnose specific learning gaps and implement targeted remedial strategies.
- Research Contribution: As a validated tool, it provides a reliable foundation for future experimental and correlational research within the field of Mathematics education.

Test validity is defined as the extent to which an instrument measures what it intends to measure. To ensure content validity, the test items were developed in strict accordance with the instructional objectives of the specific content area. The tool's validity was further established through a rigorous review by a panel of ten educators.

Face validity was established through the unanimous approval of the evaluators, who expressed full satisfaction with the test items. Nevertheless, the lack of an existing standardized benchmark for this specific domain precluded the establishment of concurrent validity.

TOOL FOR THE FINAL STUDY

Based on the item analysis, items were excluded if their Difficulty Index fell above 75 and below 50. Similarly, items with a Discrimination Index falling below .40 were removed. Following the deletion of 40 items from the initial pool of 90 items, the investigator selected the remaining 50 items to finalize the Achievement Tool.

Table – 5

BLUE PRINT TWO DIMENSIONAL CHART OF THE FINAL DRAFT OF THE CRITERION TEST TOOL

Content	Knowledge	Understanding	Application	Analysis	Total Mark
POLYNOMIALS	3(1)	5(1)	3(1)	3(1)	14(1)
CIRCLES	3(1)	5(1)	5(1)	3(1)	16(1)
PRISMS	4(1)	6(1)	7(1)	3(1)	20(1)
Total	10(1)	16(1)	15(1)	9(1)	50(1)

CONCLUSION

Designed with teachers and researchers in mind, this study introduces a scientifically validated, 50-item multiple-choice test for ninth-grade Mathematics. This criterion-referenced instrument perfectly mirrors curriculum goals and cognitive learning objectives, providing a dependable and ready-to-use tool for classroom evaluation.

References

1. Lorin W Anderson (2001). A Taxonomy for Learning Teaching and Assessing: A revision of Blooms Taxonomy of Educational Objectives.
2. Thorndike, 7th edition (2005). Measurement and Evaluation in Psychology and Education.
3. Anthony J. Nitko & Susan M Brookhart A. J. (2001). Educational Assessment of Students.
4. Linda L Cook & Mary J Pitoniak. (2025). Educational Measurement.
5. Gilbert Sax, G. (1980). Principles of Educational and Psychological Measurement and Evaluation.
6. Kerala State Board (2024). Mathematics Textbook for IX Standard. Government of Kerala.
7. Robert L. Ebel (1972). Essentials of Educational Measurements.
8. Blaine R. Worthen (1973) Educational Evaluation: Theory and Practice.
9. Robert F. Devellis. (2017). Scale Development: Theory and Application.
10. Radha Mohan. (2016). Measurement, Evaluation and Assessment in Education.
