

CONSTRUCTION AND STANDARDIZATION OF ACHIEVEMENT TEST IN BIOLOGY

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Abstract

Achievement test is an important tool in school evaluation and has great significance in measuring instructional progress and progress of the students in the subject area.

Achievement means one's learning attainments, accomplishments, proficiencies, etc. It is directly related to the pupil's growth and development in educational situations.

Tests should give an accurate picture of students' knowledge and skills in the subject area or domain being tested. Accurate achievement data are very important for planning curriculum and instruction and for program evaluation. Test scores that overestimate or underestimate students' actual knowledge and skills cannot serve these important purposes. The investigator conducted a study to construct and standardize the achievement test in biology for 11th class students based on their NCERT books on the basis of the blue print prepared for the achievement test in the light of objectives. After the items were written, the investigator consulted the language and subject expert for checking the items framed with respect to the faulty language and defects in wordings and also to verify whether the items measure what was purports to measured at the level of achievement. For trying out the preliminary draft of the achievement test, the test was given to the sample of 100 students of class 11th. The difficulty value (DV) and discriminatory power (DP) of the test items were determined by adopting Kelley's (1939) method. On the basis of the DV and DP the preliminary draft of the achievement test was modified. In total 100 items

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having difficulty value (DV) ranging from 0.20 to 0.75 and the items ranging from 0.20 to 0.90 on the discriminatory power (DP) were retained.

Key Words: Achievement test, difficulty value and discriminatory power.

INTRODUCTION:

Achievement test: An achievement test is a test of developed skill or knowledge. The most common type of achievement test is a standardized test developed to measure skills and knowledge learned in a given grade level, usually through planned instruction, such as training or classroom instruction. Achievement tests are often contrasted with tests that measure aptitude, a more general and stable cognitive trait.

Achievement test scores are often used in an educational system to determine what level of instruction for which a student is prepared. High achievement scores usually indicate a mastery of grade-level material, and the readiness for advanced instruction. Low achievement scores can indicate the need for remediation or repeating a course grade.

Definition

“Any test that measures the attainments and accomplishments of an individual after a period of training or learning”.....**NM Downie**

‘The type of ability test that describes what a person has learned to do’.....**Thordike and Hagen**

“A systematic procedure for determining the amount a student has learned through instructions”.....**Groulund.**

Achievement test in Biology:

The general purpose of an exam is to test student knowledge: “At its most basic level, assessment is the process of generating evidence of student learning and then making a judgment about that evidence.” (Elliott, 2008, p. 1). Exams can be much more than a simple evaluation of student performance in that they can form a crucial and central part of quality learning by involving students in the design of exams. Exams as such can have various functions. They can

assume a recruitment / selection function (deciding on who advances and who does not), a didactic function (monitoring the teaching and learning process), a socialization function (success in an exam leads to a certain social status), as well as the production of scientific knowledge.

Measurement and evaluation in any subject is only possible through a standardized achievement test in that concerning subject, which not only assessed the student's potentials but also give a qualitative feedback to the teachers so that they improve accordingly in their further teachings. So overall standardization of a achievement test would be a crucial stage. Here the researcher has tried in biology of 11th class as per the NCERT book for the same.

1. Planning of the test:

The planning of the test was done according to various aspects such as age of the learner, class, previous knowledge, purpose of the test, identifying and defining the intended learning outcomes, subject matter included in the computer based test and paper pencil test methods. The investigator planned the test considering the following steps:

1. *Purpose of the test:* The biology achievement test was develop in accordance with two purpose namely, (a) the comprehensive study and utility of the experimental method for paper pencil and computer based examination, (b) to determine the effectiveness of the computer based and paper pencil tests method.

2. *Target population:* The target population comprised of science students of 11th class of Kendriya Vidyalaya, C.B.S.E based schools in Allahabad, where the facility to impart computer and internet access is available.

3. *Content of the test:* The content of the test was chosen from 11th class biology students. Overall 10 chapters were selected from the 11th class NCERT book of biology. Later on, two almost similar chapters were made in one unit so overall 5 units were tested consisting of 60 questions in each. The final draft would have only selected 100 questions for paper pencil test and computer based tests separately having 20 items from each unit and 10 items from each chapter.

4. *Objective of the test:* The objectives of the biology achievement test were set in behavioral terms according to Bloom taxonomy of educational objectives.

5. *Types of test items:* The biology achievement test comprised of four options of multiple choice objective test items. The students were instructed properly to select the correct answer from four options. Initially a pool of overall 300 items were selected for the first draft of the test. The items were edited with respect to language clarity, relevance and ambiguity. Appropriate instruction for the subjects to attempt the test were prepared and written.

2. Blue print of first draft of biology achievement test

Units	Knowledge	Comprehension	Application	Total
Unit 1 (Plant kingdom & animal kingdom)	24	21	15	60
Unit2 (Anatomy of flowering plants & structural organisation in animals)	24	21	15	60
Unit 3 (Cell: the unit of life & cell cycle and cell division)	24	18	18	60
Unit 4 (Photosynthesis in higher plant & respiration in plants)	15	18	27	60
Unit 5 (Digestion and absorption & body fluid and circulation)	15	21	24	60
Total	102	99	99	300

3. First draft of biology achievement test:

After constructing the preliminary draft of biology achievement test, the expert opinion was gathered from the subject experts as well as measurement & evaluation experts. After discussion with them, their suggestions were also edited.

4. First tryout of biology achievement test and item analysis:

Item analysis is an analysis of response made to 'teacher made tests' by the pupils in the class. It can be defined as a statistical procedure by which the appropriate items are selected for the final

draft and poor items are rejected. It is a process of examining of the responses of the students in the sample group to each of the test item. Thus the process of determining the relative difficulty value (DV) and discriminating power (DP) of the test item is known as item analysis. The difficulty value (DV) and discriminating power (DP) of the test items were determined by adopting Kelley's (1939) method. The preliminary draft was administered to a sample of 100 students of class 11th in three C.B.S.E. Board affiliated schools in Allahabad. The ability of an item to discriminate between higher ability examinees and lower ability examinees is known as item discrimination. The use of the difference between the proportion of high achieving examinees that scored the item correctly and the proportion of low achieving examinee that scored the items correctly necessitates splitting the examinee into two groups. However, here upper and lower 27 % were taken into consideration. Its value ranges from -1 to +1. A positive index indicates that a higher proportion of the upper group answered the item correctly, while a negative item discriminate index indicated that a larger proportion of the lower group answered the item correctly. Thus the difficulty value (D.V.) and discriminating power (D.P.) were computed according to the following formulae:

$$D.V. = (R_u + R_l) / N$$

$$D.P. = (R_u - R_l) / N/2$$

Where,

R_u = Number of right responses in the upper group

R_l = Number of right responses in the lower group

N = Total number of students in both the groups

The selection of the items was done based on the following range of DP and DV as given below:

5. DV of the items of the achievement test:

S. No.	DV	Frequen cy	Item No.	Remarks
1.	Above 0.75	5	32, 53, 87, 88, 247	Rejected
2.	Between 0.20 to 0.75	280	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 16, 17, 18, 19, 20, 21, 22, 23, 25, 26, 27, 28, 29, 30, 31, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 54, 55, 56, 57, 58, 59, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 89, 90, 91, 92,	Accepted

			93, 94, 95, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 111, 112, 113, 114, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 143, 146, 147, 148, 150, 151, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200...246, 248.....300.	
3.	Below 0.19	15	12, 14, 15, 24, 60, 96, 110, 115, 131, 142, 144, 145, 149, 152, 179	Rejected

This above table shows that 280 items ranging from 0.20 to 0.75 were retained in the achievement test. Items having DV of below 0.19 and items having DV of above 0.75 were rejected.

6. DP of the items of the achievement test:

S. No.	DP	Frequency	Item nos.	Remark
1.	Between 0.40 and 0.90	168	1, 3, 5, 8, 9, 10, 16, 17, 18, 19, 20, 22, 23, 25, 26, 28, 30, 31, 34, 35, 36, 38, 39, 43, 44, 48, 51, 52, 58, 59, 61, 64, 65, 68, 69, 70, 72, 74, 75, 78, 79, 81, 82, 85, 86, 89, 90, 94, 97, 98, 99, 100, 102, 103, 105, 106, 108, 109, 112, 113, 114, 117, 118, 119, 120, 121, 122, 124, 125, 126, 127, 128, 130, 133, 134, 138, 139, 140, 141, 143, 146, 147, 150, 151, 153, 157, 158, 160, 161, 162, 163, 164, 167, 168, 169, 171, 173, 174, 175, 176, 177, 181, 182, 183, 185, 187, 188, 189, 191, 192, 194, 195, 196, 199, 200, 201, 202, 203, 204, 206, 207, 208, 213, 215, 216, 217, 218, 223, 224, 225, 226, 227, 228, 231, 232, 233, 237, 238, 239, 242, 243, 251, 252, 255, 258, 259, 261, 262, 264, 265, 267, 268, 269, 270, 271, 272, 273, 274, 276, 277, 278, 279, 280, 282, 286 289, 290, 291	Very good items

2.	Between 0.30 and 0.39	32	7, 11, 13, 29, 33, 40, 47, 54, 55, 56, 63, 73, 83, 92, 93, 107, 129, 154, 155, 165, 180, 184, 186, 209, 212, 241, 246, 260, 281, 294, 295, 296,	Reasonable good items
3.	Between 0.20 and 0.29	31	6, 42, 53, 62, 71, 76, 77, 84, 88, 91, 123, 132, 135, 136, 166, 193, 219, 229, 247, 248, 249, 250, 254, 256, 257, 266, 283, 287, 288, 292, 293	Marginal items subjected to modification
4.	0.19 and below	69	2, 4, 12, 14, 15, 21, 24, 27, 32, 37, 41, 45, 46, 49, 50, 57, 60, 66, 67, 80, 87, 95, 96, 101, 104, 110, 111, 115, 116, 131, 137, 142, 144, 145, 148, 149, 152, 156, 159, 170, 172, 178, 179, 190, 197, 198, 205, 210, 211, 214, 220, 221, 222, 230, 234, 235, 236, 240, 244, 245, 253, 263, 275, 284, 285, 297, 298, 299, 300	Poor items

This above table shows that 168 items were considered very good and no revision was required as the items having DP range from 0.40 to 0.90, these items were selected as such for the final draft 32 items with DP ranging from 0.30 to 0.39 were good and needed little revision, 31 items between 0.20 to 0.29 needed to modify with respect to language and and clarity and the remaining 69 items which had DP 0.19 and below were rejected.

7. Second try out of biology achievement test and item analysis:

The revised draft of the biology achievement test was again administered to another group of students of 100 biology students of class of CBSE affiliated schools. Distribution of discriminating power (D.P.) of items of first draft of biology achievement test after second tryout:

Discriminating power	Frequency	Remarks
0.40 and above	168	Very good items
Between 0.30 and 0.39	32	Reasonably good
Between 0.20 and 0.29	31	Needs improvement
Below 0.19	69	Very poor
Total	300	

Thus, according to the D.P. Computed for each items, based on the above table, out of 300 items 200 items were retained for the final draft. These items were again revised in terms of language, description and their option. Thus the final draft of biology achievement was formed. The table given below is showing the blue print of final draft:

Final blueprint of achievement test for paper pencil test:

Units	Kno wled ge	Comp rehens ion	App licat ion	Tot al
Unit 1 (Plant kingdom & animal kingdom)	8	7	5	20
Unit2 (Anatomy of flowering plants & structural organisation in animals)	8	7	5	20
Unit 3 (Cell: the unit of life & cell cycle and cell division)	8	6	6	20
Unit 4 (Photosynthesis in higher plant & respiration in plants)	5	6	9	20
Unit 5 (Digestion and absorption & body fluid and circulation)	5	7	8	20
Total	34	33	33	100

8. Scoring:

The scoring procedure followed for the final draft has been given below:

- All the items carry equal marks.
- For each correct response, a score of 1 was assigned and zero for incorrect response.
- There were no negative marking.
- Maximum marks for the test: 100 & maximum provided time: 120 minutes.

9. Reliability of Achievement Test:

The reliability of a measuring instrument is the degree of consistency with which it measures whatever it is measuring. The more reliable the test is, the more confidence the researcher can have that the scores obtained from the administration of the test are essentially the same scores that would be obtained if the test were re-administered. Cattell (1964) defined reliability as the extent to which the test gives the same results with the same sample on different occasions. Reliability in research is essentially a synonym for dependability, consistency and replicability over time, over instruments and over groups of respondents. It is concerned with precision and accuracy. The reliability of the present test was determined by test --retest method. The test was administered to group of students and re-administered to the same group after a gap of 21 days. The correlation between the scores was found to be 0.89. Thus the reliability coefficient of the test was 0.89, which indicated that the biology achievement test is fairly reliable. The following formula was used to compute correlation:

$$r = \frac{\sum xy}{\sqrt{\sum x^2 \sum y^2}}$$

where; r=reliability coefficient

n

x= deviation from Actual mean of X

y=deviation from Actual mean of Y

10. Validation of Achievement Test:

Validity is an indispensable characteristic of measuring devices. Validity is the most important aspect of a test which can be defined as the degree to which a test is capable of measuring the achievements for which it is designed. The first essential quality of a valid test is that it should be highly reliable. In general, a test is valid if it measures what it claims to measure. A test however, does not possess universal and eternal validity.

In the present study, the biology achievement test was validated against the criterion of content validity. The content of the entire test was thoroughly inspected by the experts and comment on whether each item approximately matched to the content area specified. The contents were then carefully compared with the objective of the course of instruction. Since, there was conformity

between the table of specification and test items, the biology achievement test was found to possess content validity. For assessing the construct validity, the investigator ensured the organization of the selected content in a logical and orderly manner according to the age and level of the learner so biology achievement test confirmed to the requirement for the constructive assertion.

References:

- Ann, P.S. (2004). Measurement, assessment and evaluation. Lagos: Concept Publication Ltd.
- Jayanthi, J. (2014). Development and validation of an achievement test in Mathematics. *International Journal of Mathematics and Statistics Invention*, 2(4), 40-46.
- Joe, A.L. (1995). Basic Concepts of Educational Measurement and Evaluation. Port Harcourt: Paragraphics.
- Ohuche, R.O., & Akeju, S.A. (1988). Measurement and Evaluation in Education. Onitsha: African- Fep Publishers Ltd.
- Osadebe, P.U. (2014). Construction of Biology Achievement Test for Assessment of Students. *World Journal of Education*, 4 (2). 58-64