



DEVELOPMENT OF ACHIEVEMENT TEST: A RESEARCH TOOL FOR 11TH GRADE STUDENTS

¹Shipra Rana and ²Dr. Nain Singh

¹Ph.D. Research Scholar and ²Department of Education

^{1&2}Himachal Pradesh University,

Summer Hill, Shimla, Himachal Pradesh, India

Abstract

This paper is a modest contribution to the large house of psychological and educational tests available in various branches of human assessment. The paper reports the process of development and standardization of Achievement Test Questionnaire in Biology for 11th Grade students to measure their academic achievement in the specific content ‘Transport in plants’ and ‘Photosynthesis in Higher Plants’. The Achievement Test consisted of 70 multiple choice questions designed on the prescribed syllabus of Himachal Pradesh Board of School Education, Dharamshala. The items of the test covered the Knowledge, Understanding and Application domain of the Bloom’s Taxonomy. Item analysis was done by calculating item difficulty value and item discrimination index of all the 83 items of the pilot study on the basis of Kelly’s method. The test items having difficulty index between 30-70% and discrimination index between 0.30 to 0.70 were kept for the final draft by the investigators. The test-retest reliability of the Achievement Test Questionnaire in Biology came out be 0.84 which is highly significant at 0.05 level of significance. The various drafts of the test were presented to the experts in the field and biology subject teachers before finalizing the final draft. Hence the test possesses content validity.

Keywords: Development, Achievement, 11th Grade Students.

Introduction

The world today is becoming more and more competitive, and the quality and level of achievement in the academics has become an important educational touchstone in formal settings. The entire teaching-learning activities in the school revolve around academic achievement. Higher level of academic achievement shapes the attitude of the students towards the educational system. Academic achievement in general refers to the display of superior performance in scholastic activities. Singh, et. al (2007) remarked “academic achievement is the acquisition of principles and generalizations and the capacity to perform efficiently certain manipulations, objectives, symbols and ideas. The assessment of academic achievement has been largely confined to the evaluation in terms of information, knowledge and understanding. It is the competence of students shown in school subjects for which they have taken instruction. The test scores or grades assigned to the students on the basis of their performance in the achievement test determine the status of pupils in the classroom.”

Thus, it can be said that Academic Achievement is the sole criteria to evaluate the successful accomplishment of performance in a particular subject, area or course. In fact, the entire education system centrifuges around the academic achievement of students.

Rationale for the Construction of the Tool

The senior secondary level includes Biology as one of the subjects and any student of 11th grade ought to score the minimum pass marks, or else the student would be declared fail. It is in this context, academic achievement in Biology becomes valuable and significant in the further continuation of studies. Since there was no standardized test tool based on the specific area of content selected, therefore, the investigators developed and standardized the achievement test to be administered upon a larger sample of study. The achievement test would prove beneficial to the entire student community of 11th grade to prepare for academic and competitive exams as well.

A close examination of the literature shows that the educational studies of (Kara and Celikler, 2015; Anandharaja, et. al 2016; Mani, 2017; Sener and Tas, 2017; and Chaurasia and Singh, 2019;) also developed research tools for assessing the students’ academic achievement, students’ gain related to cognitive perspective and students’ self-confidence at upper primary and middle level of school education related to specific area of content selected by them. Therefore, it is worthwhile to develop and standardize an achievement test as a research tool to meet the purpose.

Objective of the Study

1. To construct and standardize achievement test on selected content of Biology subject for 11th grade students.

Research Method

The investigators have adopted Survey method to carry out the development of the research tool.

Sample of the Study

The 60 students from four different Government Senior Secondary Schools in Shimla district of Himachal Pradesh studying in 11th grade medical stream constituted the sample of the study.

Achievement Test Questionnaire in Biology

a) Preparation of the Initial Draft: Item Pooling

After the thorough analysis of the syllabus, the investigators selected two chapters viz ‘Transport in Plants’ and ‘Photosynthesis in Higher Plants’ from Unit-IV (Plant Physiology) of the biology subject at 11th standard. The test items were pooled from the selected chapters of 11th grade biology subject to construct and standardized the achievement test. The items of the achievement test were framed under three domains as recommended by Marshall and Hales (1972) namely Knowledge, Understanding and Application. The investigator developed objective type achievement test in which each question was provided with four choices out of which only one was correct and rest three responses were incorrect. The initial draft of the achievement test scrutinized by the investigators consisted of 94 questions. The draft was presented to panel of subject experts and lecturers in Biology subject to point out if any item of the test was beyond students’ mental level or comprehension. Based on the suggestions of the panel, modifications were made accordingly to the level of the 11th grade students. Finally, 82 items were selected for the second draft of the achievement test.

b) Pilot Study: Try Out of the Second Draft

The second draft of the achievement test was tried out on a sample of 60 students to find the difficulties of the respondents in response to the items and to finalize the items of the test. Sample was selected on a random basis from a school of Shimla affiliated to Himachal Pradesh Board of School Education. Lindquist (1970) pointed out that a pre-try out is “the preliminary administration of the tentative deficiencies but with no intention to analyzing pre-try out data for individual items”. Based on respondent’s responses minor changes in language and sentence correction in some items were made. Weak and defective items, very simple and very difficult items were identified and again restructured with the help of the experts.

c) Item Analysis

To write effective items, it is obligatory to examine whether they are measuring the fact, idea or concept for which they are intended. Item analysis is an important tool to uphold test effectiveness and fairness by analyzing items characteristics in the numerical form. It serves as the basis for the selection and rejection of the items of the test under construction. Item analysis include two different characteristics namely, item difficulty and item discrimination.

i) Item Difficulty

It refers to the percentage of students who answer the item correctly. Item difficulty index tells us the easiness or difficulty of a test. Higher the index, the easier the question. A question with difficulty index between 30-70% is acceptable but as regard to the internal consistency or homogeneity, difficulty index between 50-60% is likely to be reliable. In the present study, the difficulty value of the 83 items of the achievement test in biology were assessed by the method given by Kelly in 1939 which showed that when each group consist of 27% of the total, it can be said with the highest degree of certainty that those in the group are really superior to those in the low group. By using 27% higher scores and 27% lower scores, test items having difficulty index between 30-70% were kept for the final draft by the investigator.

ii) Item Discrimination

It is an indicator showing how significantly a question discriminates between high and low students. Higher the item discrimination index, the more a question will distinguish between high and low students.

The table 3.1 below depicts the item analysis of the test items in the second draft of achievement

Item Number	Item Difficulty Value	Item Discrimination Index	Remarks
Item No. 1	56.2	0.50	Selected
Item No. 2	40.6	0.43	Selected
Item No. 3	43.7	0.62	Selected
Item No. 4	46.8	0.56	Selected
Item No. 5	31.2	0.12	Rejected
Item No. 6	62.5	0.50	Selected
Item No. 7	59.3	0.68	Selected
Item No. 8	37.5	0.25	Rejected

Item No. 9	40.6	0.18	Rejected
Item No. 10	46.8	0.43	Selected
Item No. 11	43.7	0.62	Selected
Item No. 12	71.8	0.56	Selected
Item No. 13	53.1	0.68	Selected
Item No. 14	50.0	0.50	Selected
Item No. 15	46.8	0.68	Selected
Item No. 16	50.0	0.37	Selected
Item No. 17	65.6	0.56	Selected
Item No. 18	56.2	0.75	Selected
Item No. 19	34.3	0.43	Selected
Item No. 20	50.0	0.75	Selected
Item No. 21	43.7	0.12	Rejected
Item No. 22	62.5	0.62	Selected
Item No. 23	46.8	0.68	Selected
Item No. 24	43.7	0.50	Selected
Item No. 25	59.3	0.56	Selected
Item No. 26	56.2	0.62	Selected
Item No. 27	53.1	0.18	Rejected
Item No. 28	53.1	0.68	Selected
Item No. 29	46.8	0.68	Selected
Item No. 30	68.7	0.50	Selected
Item No. 31	53.1	0.43	Selected
Item No. 32	50.0	0.62	Selected
Item No. 33	62.5	0.62	Selected
Item No. 34	65.6	0.18	Rejected
Item No. 35	62.5	0.75	Selected
Item No. 36	50.0	0.12	Rejected
Item No. 37	65.6	0.68	Selected
Item No. 38	59.3	0.31	Selected
Item No. 39	68.7	0.62	Selected
Item No. 40	65.6	0.56	Selected
Item No. 41	43.7	0.62	Selected
Item No. 42	56.2	0.75	Selected
Item No. 43	53.1	0.06	Rejected
Item No. 44	50.0	0.75	Selected
Item No. 45	53.1	0.68	Selected
Item No. 46	53.1	0.56	Selected
Item No. 47	59.3	0.43	Selected
Item No. 48	68.7	0.50	Selected
Item No. 49	46.8	0.68	Selected
Item No. 50	62.5	0.62	Selected
Item No. 51	68.7	0.62	Selected
Item No. 52	37.5	0.12	Rejected
Item No. 53	50.0	0.75	Selected
Item No. 54	43.7	0.62	Selected
Item No. 55	56.2	0.62	Selected
Item No. 56	59.3	0.68	Selected
Item No. 57	65.6	0.68	Selected
Item No. 58	65.6	0.43	Selected
Item No. 59	46.8	0.68	Selected
Item No. 60	53.1	0.68	Selected

Item No. 61	37.5	0.50	Selected
Item No. 62	62.5	0.62	Selected
Item No. 63	71.8	0.56	Selected
Item No. 64	40.6	0.56	Selected
Item No. 65	62.5	0.75	Selected
Item No. 66	50.0	0.25	Rejected
Item No. 67	62.5	0.50	Selected
Item No. 68	65.6	0.56	Selected
Item No. 69	40.6	0.43	Selected
Item No. 70	46.8	0.43	Selected
Item No. 71	50.0	0.50	Selected
Item No. 72	43.7	0.37	Selected
Item No. 73	71.8	0.43	Selected
Item No. 74	71.8	0.18	Rejected
Item No. 75	59.3	0.68	Selected
Item No. 76	31.2	0.37	Selected
Item No. 77	40.6	0.31	Selected
Item No. 78	53.1	0.68	Selected
Item No. 79	62.5	0.25	Rejected
Item No. 80	46.8	0.56	Selected
Item No. 81	56.2	0.75	Selected
Item No. 82	62.5	0.62	Selected

After carrying out the item analysis, 12 items from the second draft were eliminated out to form the final draft. The final draft was again presented to the panel of experts for removing ambiguity and re-structuring and revision of items. On the basis of comments and suggestions by the experts, the achievement test was again revised and modified. The final draft of achievement test consisted of 70 items keeping in view the length and content matter of the selected content. The discrimination index of the test items in the final draft is shown below in the table 3.2.

Table 3.2 Discriminating Power for the Test Items of the Final Draft of Achievement Test

Discriminating Index	Frequency	Remarks
0.60 and above	37	Excellent Items
0.40 and above	28	Good Items
Between 0.30 and 0.39	05	Average Items
Between 0.20 and 0.29	00	Needs Improvement
Below 0.19	00	Poor Items
Total	70	

Scoring Procedure of the Test

The final draft of the achievement test consisted of 70 items in the form of multiple-choice questions. Each question/item in the test has four alternatives to respond. The respondents have to select only one alternative. The scoring of the achievement test was prepared by the investigators. A score of 1 was allotted to the right response and a score of 0 was allotted to the wrong response. For unanswered questions too, a score of 0 was allotted. The maximum score of the test was 70 and the minimum score was 0. The test was printed in English language with necessary directions for the respondents.

Reliability of the Test

Reliability is a measure of the stability or consistency of test scores. A reliable test will accurately measure knowledge for every student who takes it and reliable research findings can be replicated over and over.

The reliability of the final draft of the achievement test in biology was established using test-retest method and split-half method.

Reliability of the achievement test using Test-Retest Method

The achievement test was administered to a sample of 60 students twice with a gap of 15 days. The responses of students were scored separately. The coefficient of correlation was calculated between the two sets of the achievement test scores for the same set of 60 students is shown in the table 3.3 below.

Table 3.3 Reliability of the Achievement Test

Administration of Tool	No. of Students	Mean	S.D.	R
Test	60	36.85	8.1	0.86**
Re-Test After 15 Days	60	26.35	6.2	

Note: ** indicates that the calculated value is highly significant at 0.01 level of the significance.

The table value with df 58 at 0.01 level = 0.33 and at 0.05 level = 0.25

The test-retest coefficient of correlation of achievement test in biology came out to be 0.86 which is highly significant at 0.01 level of significance. Therefore, the achievement test in biology is a reliable tool for measuring the academic achievement of students in biology subject.

Reliability of the Achievement Test using Split-half method

The achievement test is divided into two equal halves using odd-even method. All the odd numbered items of the test constituted one part of the test and all even numbered items constituted another part of the test. The coefficient of correlation was calculated between the two parts of the test for the same set of 60 students. The split half reliability by applying the Spearman-Brown prophecy formula is shown in the table 3.4 below.

Table 3.4: Reliability of the Achievement Test using Split-half method

Reliability	N	r-value	Index of Reliability
Split-half Method	60	0.62	0.77

The split-half reliability of the achievement test in biology by using the Spearman-Brown prophecy formula came out to be 0.77. Therefore, the achievement test in biology is a reliable tool for measuring the academic achievement of students in biology subject.

Validity of the Test

Validity of the test is the truthfulness of the test. It refers to the test's quality to measure what it intended to measure, that is, "the degree to which the test actually succeeds in measuring what it sets out to measure is called its validity." In the words of Gates, "A test is valid when it measures truly and accurately the ability (or) quality one wants to appraise."

The various drafts of the achievement test in biology were time and again observed and validated by the biology subject experts working at the senior secondary level. All of them were satisfied with the items of the test. Hence, the achievement test in biology possesses content validity.

Discussion

The use of a standardized test such as the developed achievement test will have a constructive influence on the learning process of students. Such test encourages the students to use their intellectual abilities, helps the teacher with information regarding students' needs and abilities. It also helps to pinpoint the effectiveness of the classroom instruction and identify students who were performing below standards. These standardized tests are also non-discriminatory as the content provided to all the students is same, thus, helps in establishing educational equity

Conclusion

The test was constructed for measuring the Academic Achievement in Biology subject of 11th grade students. Systematic efforts were made to validate the tool using appropriate statistical techniques and so the tool can be used to measure the academic achievement of the 11th grade students in Biology subject. It is believed that this achievement test can help to determine the readiness level of the students for that competitive edge and their knowledge in the concepts for better understanding of the related concepts. The findings of the tool will be helpful to identify the level of academic achievement in Biology and take appropriate measures to improve their performance.



References

- Anandharaja, S., Balakrishnan, V., & Lawrence, J. (2016). Development and Standardization of Academic Achievement Test in Social Science. International Journal of Computational Research and Development, 1(1), 97-101, ISSN: 2456-3137. Retrieved from https://www.academia.edu/30618060/DEVELOPMENT_AND_STANDARDIZATION_OF_ACADEMIC_ACHIEVEMENT_TEST_IN_SOCIAL_SCIENCE
- Chaurasia, P., & Singh, S. (2019). Construction and Standardization of Test of Algebraic Reasoning (TAR) for Class VIII Students. Journal of Advances and Scholarly Researches in Allied Education, 16(6), 137-144, ISSN: 2230-7540. Retrieved from https://www.academia.edu/39531191/Construction_and_Standardization_of_Test_of_Algebraic_Reasoning_TAR_For_Class_VIII_Students
- Kara, F., & Celikler, D. (2015). Development of Achievement Test: validity and reliability Study for Achievement Test on Matter Changing. Journal of Education and Practice, 6(24), 21-25, ISSN: 2222-288X. Retrieved from <http://files.eric.ed.gov/fulltext/EJ1078816.pdf>
- Kelly, T. L. (1939). The Selection of Upper and Lower Groups for the Validation of Test Items. Journal of Educational Psychology, 30(1), 17-24, Retrieved from <http://doi.org/10.1037/h0057123>
- Lindquist, E. F. (1970). Statistical Analysis in Educational Research. Calcutta: Oxford and IBH.
- Mani, S. (2017). Developing and Validating an Instrument for Assessing Academic Self Confidence of Higher Secondary Students. Journal of Contemporary Educational Research and Innovations, 7(5), 225-235, ISSN: 2249-9636. Retrieved from https://www.academia.edu/36304366/DEVELOPING_AND_VALIDATING_AN_INSTRUMENT_FOR_ASSESSING_ACADEMIC_SELF_CONFIDENCE_OF_HIGHER_SECONDARY_STUDENTS
- Marshall, J. C. & Hales, L. W. (1972). Essentials of Testing. California: Addison-Wesley.
- Sener, N., & Tas, E. (2017). Developing Achievement Test: A Research for Assessment of 5th Grade Biology Subject. Journal of Education and Learning, 6(2), 254-271, ISSN: 1927-5269. Retrieved from <http://files.eric.ed.gov/fulltext/EJ1139232.pdf>
- Singh, A., Agarwal, M., Tewari, A. D., Kumar, S., Singh, V. P., Bhaduri, I. S., & Chandershekhar, K. (2007). Learning Achievement of Class III Children – A Baseline Study, NCERT, New Delhi.