Original Article

Construction And Standardization Of An Attitude Scale Towards Science: A Study Among Higher Secondary School Students In Mizoram, India

Lalmuanzuali[1] , H.Malsawmi[2] , Prateek Chaurasia[3] , Sian Lalchhandami[4] , Vanlalruatfela Hlondo[5]

[1]Assistant Professor
[2]Professor
[3]Assistant Professor
[4]Assistamt Professor
[5]Assistant Professor
[1-5]Department of Education, Mizoram University
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Abstract

The present study deals with the process of developing and standardizing an attitude scale towards science. The constructed scale consists of 26 statements with 13 positive and 13 negative statements. The reliability and validity of the scale was also established to determine the exact usability and applicability of the scale. For scoring, the pattern suggested by Likert was followed. The norm of the scale was also established. When the scale was administered to 300 Higher Secondary School Students of Mizoram, India, it was found that 26% had positive attitude, 49.33% had neutral attitude and 24.67% had negative attitude towards science.

Key Words: Attitude, Standardization, Scale and Science

Introduction

The word attitude has been defined in many ways. Thurstone (1946) describes it as "the degree of positive or negative affect associated with some psychological object." According to Allport (1935), "an attitude is a mental or neural state of readiness, organized to all objects and situations with which it is related." Anastasia (1968) defines an attitude "as a tendency to react favourably or unfavourably toward a designated class of stimuli, such as a national or racial group, a custom or an institution. Thus, defined, attitudes cannot be directly observed but must be inferred from overt behaviour, both verbal and non-verbal."

Bloom's educational theory (1976) predicted that attitude would account for up to 25% of the variability in students' achievement scores. Therefore, it is imperative to instill the right attitude towards any subject to enhance one's interest in that area and create an environment conducive to learning.

Attitude towards science

Attitude towards science reflects the feelings, notions, and values about science as a subject of study and includes the understanding of the use and impact of science and technology in society. It comprises of positive or negative feelings concerning the science subject, beginning from the school level. From then on, it translates into the choice of undertaking science as a subject at the higher stages of the academic study, to investments of time or money towards the study of science or science-related activities. Attitude towards science is linked with the views and images that the individual develops about science as a result of interaction with different situations (Bennett, 2003). Yara (2009)

defines attitude towards science as "interest or feelings towards studying science. It is the students' disposition towards liking or disliking science."

One of the most important aims of science teaching is to impart a positive attitude towards science at the school level. If a child has a positive attitude towards science, the learning process related to science topics, activities, and interaction with people or things associated with science will be a positive experience. Such a positive attitude can help to motivate them and to develop a deep interest in acquiring scientific information and science process skills. Students with a positive attitude had higher science achievement as compared to those with a negative attitude towards science. (Hough & Piper, 1982; Wilson, 1983; Freedman, 1997; Mattern & Schau, 2002). Meanwhile, a child with a negative attitude towards science will be more disinclined towards studying science, interacting with people related to the field of science, and taking part in science-related activities.

Rationale of the study

Attitudes are not innate or inborn. Students do not begin school by liking or disliking science lessons. Rather, students learn whether or not they have a preference for the subject once they begin the science lessons in school (Koballa & Crawley, 1985). Contemporary psychologists maintain that attitudes are determined and organized through experiences in the development of a child (Holloran, 1970; Oskamp, 1977). Students' attitude towards science varies among the student and depends on several factors. If we assure the students about acquiring successful experiences and positive feelings at the beginning of their science education, they will be motivated and will be likely to develop positive and fulfilling scientific skills in the future. In this way, students will acquire positive attitudes towards science, which will influence them to perceive the learning of science as a lifelong pursuit. However, if they have negative experiences about their science education at the school level, they are most likely to avoid pursuing science studies at higher levels which will inevitably result in developing a negative attitude towards science. Therefore, it is important especially for teachers to find out the attitude of students towards science. Consequently, constructing and standardizing an attitude scale towards science becomes an essential requirement.

Objectives

1. To construct and standardize a Likert type attitude scale towards science
2. To find out the attitude of higher secondary school students towards science in Mizoram

Objective no. 1: Construction and standardization of a Likert type attitude scale towards science

The methods followed for construction and standardization of the attitude scale towards science are discussed below.

Collection and Editing of Statements

The investigator meticulously studied science literature and various standardized attitude towards science scales to be able to develop a reliable and valid instrument for accurately measuring students' attitude towards science. The items included different science-related categories such as science as a subject in school, investments/spending on science, influence/impact on morals, using leisure time, doing/thinking about science-related activities, science and society, and the future. Utmost care was taken to make sure that each statement selected was clear, brief and unambiguous. They were carefully designed to ensure that each statement reflects the entire range of feelings, from strongly agree through undecided to strongly disagree.

At first, 56 statements articulating attitude towards science were generated for the first draft of the attitude scale. Fifteen experts from significant disciplines were requested to judge the worth of each statement. Some statements were modified and some identical statements as well as invalid statements were discarded as per the suggestions from the experts. The draft now contained 32 statements, expressing both positive and negative attitude towards science. The instructions for the scale required subjects to respond to each item on a 5-point scale, the response categories being 'strongly agree,' 'agree,' 'undecided,' 'disagree' and 'strongly disagree.'

Pre-test

While constructing a scale, an essential aspect of the process is the pre-test. Through this process, items identified as ambiguous in nature, or unclear in direction were taken out. The attitude scale was pretested on a sample of 15 higher secondary school students. Two statements which was unclear to most of the students were again discarded, thus the draft now contained only 30 items. The pre-test was carried out to know whether the scale was going to be suitable for the proposed population.

Try out

The attitude scale, consisting of 30 items was administered on a sample of 100 higher secondary school students in Mizoram. The sample selected constituted a cross-section of the higher secondary school students, representative of the population in Mizoram on whom the final scale was supposed to be administered. The investigator was able to collect 100 per cent of the forms duly completed in full. Item analysis was carefully executed to accurately find out the discriminating value of each item, which in turn helps in eliminating ambiguous items.

Item Analysis

After administering the try out, the scale was scored using Likert scoring procedure. The scores of all the 100 students were arranged in ascending order and the upper 27% and lower 27% were set aside for item analysis and discrimination.

The Mean and Standard Deviation values were computed separately for each statement of attitude scales for both the top and bottom groups. The 't-test' determines the discriminative value for all the 30 items. All the items having 't' value above 2.58, i.e., statements which are significant at 0.01 level of confidence were retained for the final scale and those statements having 't' value less than 2.58, i.e., statements, which are not significant at 0.01 level of confidence were eliminated. Eventually, the final attitude scale consisted of 26 statements. The following Table - 1 reflected the Mean and Standard Deviation values of both the top and bottom groups on each of the 30 statements and the discriminating value in the form of 't-value.'

Table – 1 Mean, Standard Deviation, and t-value of high and low groups on different Items of Attitude Scale

Item No.	High Group		Low Group		t value	Significance
	Mean	SD	Mean	SD		
1	3.52	.62	2.85	.81	3.94	**
2	3.56	.49	2.56	.79	5.88	**
3	3.11	.69	1.93	.89	5.36	**
4	3.56	.49	2.67	.6	6.36	**
5	3.11	.99	2.74	.75	1.54	NS
6	3.37	.56	2.15	.89	6.1	**
7	3.93	.24	3.26	.70	4.47	**
8	3.37	.91	2.30	.93	4.46	**
9	3.7	0.46	2.78	.73	5.41	**
10	3.44	.74	2.52	.69	4.6	**
11	3.74	.44	2.78	.95	4.8	**
12	3.22	.63	2.74	.58	3.43	**
13	2.70	1.14	2.30	.81	1.43	NS
14	3.48	.70	2.74	.8	3.7	**
15	2.96	.75	1.96	.84	4.55	**
16	3.48	.69	2.52	.79	4.8	**
17	2.60	1.06	1.67	.82	3.88	**

18	3.67	.47	3.04	.63	4.5	**
19	3.78	.41	3.33	.55	3.21	**
20	2.93	1.41	2.37	1.09	1.70	NS
21	3.11	.79	1.7	.81	7.05	**
22	3.63	0.55	2.67	0.66	5.65	**
23	3.93	.24	3.15	0.65	5.57	**
24	3.74	0.52	2.56	0.69	6.94	**
25	3.22	1.03	2.33	.92	3.42	**
26	3.44	.69	2.52	0.92	4.18	**
27	2.74	1.04	1.74	1	3.57	**
28	3.30	.8	2.74	.84	2.5	NS
29	2.67	1.01	1.63	.95	4	**
30	3.89	.32	2.81	.67	7.2	**

NS means not significant, ** means significant at 0.01 level

Establishment of Reliability

Reliability is the degree to which an assessment tool produces stable and consistent result. It is important that any standardized scale should be reliable enough to obtain trustworthy results. For establishing the reliability of the scale, the scale was again given to 100 higher secondary school students. The investigator applied 'Split-Half Method' for the establishment of reliability of the scale. The whole scale was divided into two halves by dividing the items into odd and even numbers. To ascertain the coefficient of reliability between the two halves of the scores, the Product Moment Correlation was applied. The coefficient of the reliability of the scale was 0.744 (after applying Spearman Brown's formula), which can be considered adequate for an attitude scale. Table - 2 reflects the Split-Half scores for establishing reliability coefficient of the scale.

Table No. 2 Split Half Scores for Determining the Reliability of the Attitude Scale towards Science

Sl. No.	Score on First Half	Score on Second Half	Sl. No.	Score on First Half	Score on Second Half
1	74	67	51	70	78
2	68	66	52	70	66
3	72	74	53	64	67
4	76	79	54	71	88
5	69	71	55	92	94
6	74	84	56	82	77
7	74	81	57	88	76
8	86	71	58	70	70
9	63	59	59	88	86
10	70	75	60	80	84
11	74	74	61	71	72
12	73	65	62	92	80
13	74	75	63	85	76
14	84	78	64	84	88
15	80	89	65	75	77
16	66	69	66	87	87
17	96	85	67	78	77
18	78	81	68	76	75
19	97	91	69	77	82

20	82	84	70	76	72
21	59	71	71	82	75
22	68	72	72	96	89
23	90	94	73	63	65
24	75	72	74	68	70
25	72	71	75	52	72
26	66	58	76	89	77
27	89	98	77	53	61
28	101	101	78	61	69
29	74	62	79	71	69
30	83	70	80	76	69
31	74	86	81	86	78
32	78	85	82	81	79
33	67	72	83	79	82
34	67	68	84	87	86
35	82	81	85	72	77
36	71	66	86	74	66
37	81	81	87	79	77
38	82	85	88	75	72
39	66	45	89	76	76
40	83	80	90	58	49
41	80	84	91	80	75
42	64	70	92	94	92
43	80	78	93	66	75
44	67	53	94	88	90
45	67	76	95	77	76
46	89	89	96	74	78
47	72	72	97	60	70
48	72	70	98	66	65
49	88	83	99	96	94
50	76	90	100	77	83

Establishment of Validity

In the process of standardization of any scale, validity is one of the crucial dimensions for measuring the effectiveness or usefulness of the same. For the present scale, content validity was established by requesting fifteen experts from various disciplines to judge the worth of each statement. To establish criterion-related validity, the investigator administered "Scientific Attitude Scale" by Dr. (Mrs) Avinash Grewal (1990) along with the newly constructed Attitude towards Science Scale to all the 100 respondents. The criterion test consists of 20 items, out of these, 10 are positive, and the remaining 10 statements are negative. Scoring for each item was done following the Likert Method by giving 4 3, 2, 1, 0 for positive statements and 0, 1, 2, 3, 4 for negative statements. After completion of both the tests, the correlation coefficient was computed between the two scales. It was found to be 0.637, which was considered suitable to study the attitudes of higher secondary science students towards science. Thus, the scale was validated using concurrent validity. The following table - 3 shows the scores of the two tests.

Table No. 3 Scores on Two Tests to Compute Criterion Related Validity

Sl. No.	Score on the present scale	Score on the criterion scale	Sl. No.	Score on the present scale	Score on the criterion scale

1	67	67	51	78	78
2	69	66	52	74	66
3	69	74	53	66	67
4	72	79	54	83	88
5	67	71	55	76	94
6	79	84	56	67	77
7	76	81	57	78	76
8	75	71	58	67	70
9	62	59	59	75	86
10	72	75	60	71	84
11	77	74	61	63	72
12	73	65	62	77	80
13	74	75	63	64	76
14	73	78	64	78	88
15	82	89	65	65	77
16	70	69	66	80	78
17	76	85	67	72	77
18	69	81	68	68	75
19	87	91	69	75	82
20	76	84	70	67	72
21	77	71	71	70	75
22	70	72	72	77	89
23	87	94	73	66	65
24	70	72	74	67	70
25	70	71	75	64	72
26	66	58	76	69	77
27	82	98	77	58	61
28	94	101	78	71	69
29	66	62	79	63	69
30	67	70	80	71	69
31	65	86	81	65	78
32	79	85	82	75	79
33	71	72	83	80	82
34	67	68	84	84	86
35	75	81	85	73	77
36	68	66	86	65	66
37	74	81	87	65	77
38	84	85	88	77	72
39	59	45	89	70	76
40	77	80	90	61	49
41	75	84	91	67	75
42	65	70	92	79	92
43	77	78	93	69	75
44	62	53	94	79	90
45	74	76	95	68	76
46	83	89	96	74	78
47	61	72	97	70	70

48	65	70	98	66	65
49	81	83	99	84	94
50	77	90	100	77	83

Scoring:

The scoring procedure follows the Likert Method. There were five responses against each item such as 'Strongly Agree,' 'Agree,' 'Undecided,' 'Disagree' and 'Strongly Disagree.' The positive items carry the weightage scores of 4, 3, 2, 1 and 0 for the responses ranging from 'Strongly Agree', 'Agree', 'Undecided', 'Disagree' and 'Strongly Disagree' and the scoring is reversed for the negative items as 0, 1, 2, 3 and 4 respectively. The highest possible score on the test was (26 X 4) 104, and the lowest possible score was (22 X 0) 0. Table - 4 presents the item numbers for positive and negative statements.

Table No. 4 Item Numbers for Positive and Negative Statements

Sl. No.	Types of Statements	Item Numbers	Total
1	Positive	1, 4, 5, 6, 8, 10, 12, 14, 16, 17, 19, 20, 23	13
2	Negative	2, 3, 7, 9,11, 13, 15,18, 21, 22, 24, 25, 26	13

Norms and Interpretation of Attitude Scale

The norms for the present study were developed using the percentile scores. The investigator administered the attitude towards science scale on a sample of 300 higher secondary school respondents from the state of Mizoram. The raw scores collected were converted into percentiles. The scores above the 75th percentile (82-100) constitute positive attitude, those below the 25th percentile (35-68) constitute negative attitude and those between the 25th and 75th percentile (69-81) constitute a neutral attitude. Table - 5 shows the norms for interpretation of the Attitude towards Science Scale.

Table – 5 Interpretation of Attitude towards Science Scale

Range of Scores	Interpretation
Above 75th Percentile (82-100) Between 25th& 75th Percentile (69-81) Below 25th Percentile (35-68)	Positive Attitude towards Science Neutral Attitude towards Science Negative Attitude towards Science

Objective no. 2: To find out the attitude of higher secondary school students towards science in Mizoram

The newly constructed attitude scale toward science was administered to 300 higher secondary school students in Mizoram. On the basis of the responses obtained from them, students were categorized into three groups in accordance with the norms of the scale. The following Table - 6 shows the number, percentages and interpretation of higher secondary school students' attitude towards science

Table – 6 Attitude of higher secondary school students towards science in Mizoram

Number of students	Percentage	Interpretation
78	26.00%	Positive attitude
148	49.33%	Neutral attitude
74	24.67%	Negative attitude

The above Table – 6 shows that when this scale was administered to 300 Higher Secondary School Students of Mizoram, it was found that majority of the students i.e. 148 (49.33%) had neutral attitude, while 78 (26.00%) of the students had positive attitude and 74 (24.67%) of the students had negative attitude towards science. There are slightly more number of students who had positive attitude towards science rather than negative attitude towards science.

Conclusion

The majority of students in the present study had a neutral attitude towards science. The low number of positive attitude towards science among the students may be owing to a lack of adequate support provided for them at the level of the family, the educational institution, and the society at large. While there is a general understanding of the importance of developing a positive attitude towards science for fostering a keen interest in the subject, there seems to be a lack of knowledge of how to actualize such conditions. Families seem mainly focused on ensuring that their child acquires good results; however, they do not appear to be equipped to help their child develop an interest in science. In most scenarios, families entrust this responsibility to the school teachers and the children themselves. As for science teachers, many have not had sufficient training or possess the essential skills to inculcate student interest in science especially at the elementary stages of education. The resulting absence of a firm grasp or knowledge of science from a foundational/fundamental level leads to the inability to cultivate a deep-seated interest in science at the higher secondary school stage and above. A nurturing environment can foster the development of a positive attitude towards science; however, such an environment seems to be lacking at present.

Further lacking adequate infrastructure facilities for libraries, science laboratories, teaching aids, and science-related equipment adds to the challenge of cultivating a positive attitude towards science. Another factor to be considered could be the general perception among the public that science is a difficult subject that is the preserve of only brilliant students. This could have resulted in a general attitude of hesitation towards pursuing science studies which have given rise to a neutral attitude towards science among the students.

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