CONSTRUCTION AND STANDARDIZATION OF SCIENTIFIC ATTITUDE SCALE

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Abstract

The paper reports the details of the construction and standardization of Scientific Attitude Scale. The scale initially consisted of 58 items. After review and evaluation of statements by the experts, item analysis, items were reduced to 49, out of which 21 items were positive and 28 were negative. The test retest reliability was found to be 0.970. For content validity value of Index of Suitability (IOS) ranged from 0.92 to 1 and concurrent validity was calculated to be 0.475 and test developed was found to be valid.

Key Words: Scientific Attitude, Scientific Attitude Scale

Modern age is rightly termed as scientific era. At no point of time in the history of mankind did science dominate human life so overwhelmingly and so intricately as it does today. All this has been made possible because of great strides man has made in the field of science .But the scientific growth is both preceded and followed more vigorously by formation of appropriate attitude. Such attitude is termed as scientific attitude. Nair (1971) said that Scientific attitude is characterized by intellectual honesty, objectivity in drawing conclusions ,adoption of scientific and systematic procedure, open mindedness in receiving new ideas and facts ,curiosity, readiness to reconsider one's own judgments ,spirit of team, work self help and self reliance ,intellectual satisfaction from scientific pursuits, economy in use of materials ,honest recording and reporting of observation, faith in cause and effect relationship, pursuing activities with consistency, preparedness to face hardships and difficulties, a sense of dedication and faith in specialists in their respective fields. Qualities of a person who possess scientific attitude as given by Kohli (1986) are like the person having scientific attitude does not believe in superstition, such as charms or good or bad luck, he is curious concerning the things he observes, he is open minded towards work and opinions of others and information related to his problem, He evaluates techniques and procedure used and information obtained and his opinion and conclusions are based on adequate evidence.

The scientific attitude and growth of science are interdependent. The growth in one sector leads to growth in another sector. We make systematic effort for the dissemination of scientific knowledge and testing achievement of the same in the clientele, we don't care to assess the commensurate growth of scientific attitude which is often thwarted by certain extraneous factors like faith, tradition, religion etc. which don't necessarily have rational bases .The notion that a large proportion of even educated people have strong faith in superstitions in the era of science and technology. So no wonder that there is no one to one correspondence in growth in science and growth in scientific attitude which ultimately hinders the smoothness of growth of science Such a lopsided growth may not to be conducive to the growth of scientific knowledge .Since scientific thinking and scientific attitude are instrumental in expanding scientific knowledge there is a need to frequently assess the relative growth of scientific attitude particularly in the students such an exercise require

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valid and reliable tools for the measurement of scientific attitude .Standardize scientific attitude scale would not only give needed thrust to the development of scientific attitude by identifying the areas of deficiencies and by focusing the need for concede effort to wipe out such deficiencies. The related literature pertaining to this field was reviewed, review revealed that Curtis (1924) constructed first instrument to measure scientific attitude .The test was based on definition of scientific attitude consisting of four components namely; conviction of universal cause and effect relationship, habit of delayed response, habit of weighing evidence and open mindedness. Noll (1935) constructed an instrument based on another definition consisting of six components namely; accuracy, intellectual honesty, open-mindedness, suspended judgment, looking for cause and effect relationships, and criticalness, including self criticism. Srivastava (1980) constructed a thirty six item Scientific Attitude Scale in Hindi constituting six dimensions, namely; rationality, curiosity, open-mindedness, and aversion to superstitious beliefs, objectivity-intellectual honesty and suspended judgment. Singh (1993) constructed a scientific attitude scale in Hindi consisting of 40 items. Kaur (2002) constructed 61 items consisting of nine dimensions namely; curiosity, open-mindedness, faith in scientific method, cause and effect relationship, critical mindedness, seeks evidence, objectivity, suspended judgment and aversion to superstition. Indeed there are some instruments to measure scientific attitude but the major criticism is that they don't measure the scientific attitude as such but rather a mixture of attitudes concerning science, sociology of science and knowledge of the nature of science, and are based on a fairly explicit rationale. However each one suffers from one or more of the following short comings. The definition of attitudes are too general, there is tendency to lump together several dimensions of science under the caption of attitudes (interest, attitude and values are grouped with processes involved in scientific inquiry), the scale do not discriminate between the effective and cognitive components involved in attitude measurement and the content of the scale do not adequately represent classroom situation and experience. Therefore the dearth of suitable instrument to measure the scientific attitude of the student taken in the present study motivated the researcher to develop her own instrument to measure scientific attitude of the student.

CONSTRUCTION OF SCALE:

For construction of the scale on scientific attitude, literature on scientific attitude like books, abstracts available on the internet, Ph.D work done was surveyed and scanned .Teachers who were teaching science in government and private schools, colleges were consulted and discussion was carried out with them. After careful exploration and survey of literature and discussion with teachers following five dimensions were identified for the present scale:

1) Rationality: Rationality is the process of using reason or logic to solve a problem. In this scale Rationality deals with: Commitment of the value of rationality, tendency to test traditional beliefs, seeking natural course of events and identification of cause and effect relationship, acceptance is criticalness, challenges of authority.

2) Curiosity: Curiosity is an emotion that causes natural inquisitive behaviour such as exploration, investigation, and learning, evident by observation in many animal and human species. In this scale curiosity deals with: Desire for understanding new situations that are not explained, find out the 'why's' and 'how's' of an observed phenomenon, give emphasis on the questioning approach of novel situation, desire for completeness of knowledge.

3) Open mindedness: In the language of the general public, open-mindedness means being open to possible theories and explanations for a particular phenomenon. In this scale open mindedness mean: Willingness to revise opinion and conclusions, desire for new things and ideas, rejection of singular and original approach to people things and ideas.

4) Aversion to Superstitions: A scientist rejects superstition and prefers science paradigms out of an appreciation for the power of reality based knowledge. Rejection of superstitions beliefs, acceptance of scientific facts and explanations.

5) Faith in scientific method: Scientific method refers to the body of techniques for investigating

phenomena, acquiring new knowledge, or correcting and integrating previous knowledge. It is based on gathering observable, empirical and measurable evidence subject to specific principles of reasoning. A scientific method consists of the collection of data through observation and experimentation, and the formulation and testing of hypotheses. A person with scientific attitude adopts a planned procedure in solving a problem i.e. scientific method.

TARGET POPULATION

This scale is meant for Indian students in their adolescence studying in classes IX to XII.

TYPE OF TEST ITEMS

Present Scientific Attitude Scale is a five point Likert type scale. Every item is in the statements form with five response categories, namely; strongly agree (SA), agree (A), disagree (D), strongly disagree (SD) or undecided (UD) for responding. Subject is required to select the most appropriate response category.

PLANNING OF THE TEST

The test was planned to check the scientific attitude of the students. The scientific attitude is a generalized attitude towards the universe of science content and being measured in terms of its favorableness or unfavorableness.

PRELIMINARY DRAFT OF THE SCALE

After due consultations with teachers and recent literature initially 58 items for the scale were framed in five dimensions viz; Rationality, Curiosity, Open Mindedness, Faith in Scientific Method, Aversion to Superstitions.

PRE-TRY OUT

The preliminary draft was given to six judges for examining the scale. These judges were selected from the field of Education and Science who were teaching in university, colleges of education and government schools for their opinion. Their suggestions were seriously studied and genuine ones were incorporated. Accordingly out of 58 items, 4 items were deleted, 2 added and 5 were modified .So the second draft consisted of 56 items, distributed into five dimensions.

TRY OUT

Before undertaking the work of item analysis, the scale was administered to a sample of 10 students to remove the language difficulty, if any reported by them in understanding clearly the different items .Two statements with serial numbers 27, 55 were deleted as students find them difficult to understand and respond. So the scale was left with 54 items.

ITEM ANALYSIS

The second format of the scientific attitude scale containing 54 items was administered to 52 students. Biserial co-efficient of correlation was calculated for each item with the total scores of the whole test. Items with negative coefficient of correlation and insignificant correlation were dropped. Two items with serial numbers 6, 35 had negative correlation. So these two statements were dropped.

DISCRIMINATING INDEX

To ascertain whether the item differentiate between high and low group, t-ratios were worked out item wise. High and low groups were formed by using Kelly's method. The wieghtage score of each item and for each subject was summed up .On the basis of total scores, 27% top scores formed high group and 27% bottom scores formed low group.Their scored response in terms of weighted score for each item was marked out. Item analysis was carried out by employing the 't' test for each of 52 statements for higher and lower groups .Thus the significance of difference between the means was worked out to find out the discriminating power of each item, how well each item could distinguish between individuals having different attitudes. Only those items which showed significant difference between high and low groups were selected for inclusion in the final form of the scale. Items with t ratio value less than 2.008 were dropped; three items with serial numbers 23, 32, 49 were found to be insignificant. So these three items were dropped.

FINAL DRAFT OF SCALE

The final draft consisted of 49 statements in five dimensions. There are 21 positive and 28 negative items. Distribution of items in five dimensions is present in table - 1

Table – 1 Distribution of items of the scale

Sr.No.	Dimensions	Number of statements in the scale	Total Number of items
1.	Rationality	1-9	9
2.	Curiosity	10-15	6
3.	Open Mindedness	16-26	11
4.	Faith in scientific Method	27-36	10
5.	Aversion to Superstition	37-49	13

Table 2 : Distribution of positive and negative items:

Statements	Total Number	Serial Number
Positive	21	5,6,8,10,12,13,14,15,16,25,27,28,29,30,33,34,35,36,37,38,39
Negative	28	1,2,3,4,7,9,11,17,18,19,20,21,22,23,24,26,31,32,40,41, 42,43,44,45,46,47,48,49
Total	49	

DIRECTIONS FOR ADMINISTRATION

There is no time limit for the completion of the test. The students are supposed to give their true, free, frank and fearless opinion regarding each statement. No item should be left un-attempted by any student. There is no 'right' or 'wrong' answer to any of the statement. Students are supposed to put (√) before each statement on one of the five responses viz. SA, A, UD, D and SD.

PROCEDURE FOR SCORING

Scientific attitude scale can be scored by hand. A positive item weighed score of 5 for strongly agree (SA), 4 for agree (A), 3 for undecided (UD), 2 for disagree(D) and 1 for strongly disagree(SD) and negative item weighed score of 1 for strongly agree (SA), 2 for agree (A), 3 for undecided (UD), 4 for disagree(D) and 5 for strongly disagree(SD).

STANDARDIZATION OF THE TEST

RELIABILITY

Reliability was determined by test retest method for the present scale. The scale was administered to 52 students of class XI of Hoshiarpur district. The same scale was re-administered after one month to them. The test-retest reliability was calculated for whole test by Product moment co-efficient of correlation. The reliability was found to be 0.970 which is significant at 0.01 level of significance.

VALIDITY

Content validity and Concurrent validity was established for the present test.

Content Validity: Content validity was established by giving the final form of the scale to ten experts in the field of science teaching and education. Index of Suitability (IOS) was worked out. The value of IOS ranged from 0.92 to 1 which clearly shows that content of the scale measures the same traits for which it was written.

CONCURRENT VALIDITY

The concurrent validity of scientific attitude scale was investigated against external criterion of Scientific Attitude Scale by Kaur (2002).Both the scales were administered on a sample of 52 adolescents. The co-efficient of correlation was found between the scores of two scales .The two scales yielded a positive correlation of 0.475 which is significant at 0.01 level of significance. Hence concurrent validity of the scale is also established.

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