DEVELOPING AN ATTITUDE SCALE TOWARDS SCIENCE AT MIDDLE SCHOOL LEVEL

Dr. J.S. Bhardwaj
Head, Dept. Of Education
C.C.S. University Meerut

Vandana Kaushik
Junior Research Fellow, Dept. Of Education
C.C.S. University Meerut

Abstract

The aim of this study is to develop an attitude scale towards opting Science as a subject at middle school level of teaching. The research was carried out with 40 subject expert, 10 Educationist and 875 students of CBSE board studying at 6-10 grades. The study consists of five parts including literature review, item pool, experts’ opinions, administration of scale and computing the reliability and validity. While constituting the item pool, an interview was carried out with subject experts teaching science at middle school level. Among from 115 items which are directly related with the subject of attitude or which are selected from the relevant interviews. 95 of them were edited by expert opinions the five point likert type. The draft scale was administered to 875 students of CBSE board studying Science at 6-10th grade level. As a result of factor analysis, the number of items was reduced to 90. After carrying out factor analysis the Cronbach-Alfa internal integrity coefficient of the final version of the scale was found as 0.781. A split half reliability coefficient was computed for the entire group of students and for split half reliability to the correlation coefficient yields a reliability coefficient of .821. By computing the reliability of ATS, the scale was ready to be used.

Introduction

Attitudes towards science form early and have already declined when children reach the end of primary school (Murphy and Beggs). Some of this decline may be due to general pattern for pupil’s attitude towards most of school subjects to become less positive with age but it will also be due to their experience of science at school and influenced by myths and hearsay about science. Science, subject group may be considered as consisting of either the traditional subjects of biology, chemistry and physics or: an integral science courses and also includes topics, concepts and issues from other branch of science, such as an integrated “science “course. Science courses promote an awareness of the increasingly international context of scientific activity its impact and limitations as well as the constant evolution of scientific knowledge to consider science as a constantly evolving cooperative venture between individuals and among members of the international community, influenced by social, economic, technological, political, ethical and cultural surroundings.

Need of developing ATSS (Attitude Towards Science Scale)

The new technology has always changed the instructional programme, learning-teaching process, the learning styles of the students so that the teachers have to adapt to that change (Rose and Mayer, 2000). In the present days, Recent methodologies and instructional manner mentality has changed from traditional teaching supported by the
technological materials. The changing environment has increased student’s involvement, attention and arousing students interest, developing student’s attitude to the subject on positive way, in changing era there is the need of revise all the factors and dimensions according to the methodologies. Researcher aimed to determine the attitudes of the middle school level children towards opting science as a school subject. As a result of the study, students expressed positive feelings towards science but in different dimensions the responses of the students were differ.

**Difference between scientific attitude and attitude towards science**

Attitude towards science and scientific attitude are different as the scientific attitude is the way to respond or involve in a phenomenon in scientific manner. It is the way to react in certain manner including scientific thinking while the attitude towards science is the attitude of a children towards opting science as a subjects like others maths, social sciences etc. It may be positive or negative. A person who posses scientific attitude tries to be objective and sees different sides of an issue. S/he does not make rash conclusions, judgments or decisions. S/he is willing to listen to the opinion of the others and to study counter arguments or experimental evidences before taking action. A scientific attitude plays an important role in the formation of scientific Values.

**Background of the Attitude Towards Science**

**Concept of Attitude**

Thurston has defined attitude “as the degree of positive or negative effect associated with some psychological objects.” Anastasi defined it, “as a tendency to react favourable or unfavourable towards a designed class or stimuli. Thruston and Chave has used the concept of attitude to denote, the sum of a man’s inclination and feelings. Prejudice or bias preconceived notions ideas, threats and convictions about any specific topic. Allport regard, attitude as a mental and neural state of readiness of organism through experience exerting a directive or dynamic influence upon the individual’s response to all objects with which it is related.” Thus it can be said that attitude have intellectual biological, social and emotional components that are derived from experience and exercise a determining influence upon the individual’s behavior. From different definitions we might conclude that attitude is a blanket torn covering any judgement or opinion that individual render.

**Attitude towards science** indicates feeling of an individual or a group concerning science like faith in scientific method, opinion about scientists, values of science, interaction of science with individual and society and opinion held about science related social issue. It is a tendency to react favourably or unfavourably towards science in science. It is a psychological constituent inferred from the observable responses to specific stimuli related to science. It is a personal disposition which impels an individual to react to scientific activity and its implication.

**Formation of Attitudes**

According to Driscoll (1994), there are four common processes involved in the making of attitudes. 1. Integration of various specific responses of a similar type into a definite pattern of mental state. 2. Individuation of a definite mental set. 3. The effects of some trauma of fixation results in a startling and dramatic experience. This represents a sudden change in the mental state caused by some vivid experience. 4. Readiness for adoption through imitation. By way of imitation some sort of readiness to adopt an ideal develops. Attitudes are not permanent (Watts, 1991). They are retained as long as they yield satisfaction. The biggest single factor in changing attitude is the propaganda. Besides this, by the application of appropriate stimuli all attitudes can be changed. Thus, attitudes are flexible. The
The major responsibility of education is the inculcation of desirable attitudes and the elimination of unsuitable ones. The main task of the educational system, therefore, is;

- To develop in children proper social and scientific attitudes which are desirable towards the society, science and people.
- To check and modify undesirable attitudes by applying suitable stimuli.

The teacher can achieve these two ends through the instruction of prestige, expert influence, major opinion, evidence of rationality etc. Teacher should provide students with proper environment and should himself behave in the lines of desirable attitudes (Nwagbo, 2006).

### Review of related Literature

Motivation of students to be interested in science, their attitudes towards science, their view of scientist and their desire to become scientist have been investigated by science educators for many years. Noll (1935) has investigated the measurement of attitude towards experiments performed in science. Mead and Metraux’s (1957), investigation of high school students’ image of scientists. Nagy (1978) constructed the ATSI “to look for empirical support for the distinction between ‘feelings’ and ‘beliefs’ in a scientific attitude scale” (p. 355). Page et al (1979) developed a Likert-type scale of 40 items in order to evaluate the attitudes of students towards science and technology. More recently, science educators have been struggling with defining science attitudes. (Shrigley, Koballa, & Simpson, 1988) differentiating among attitudes, beliefs, and values Project 2061 (1990) (American Association for the Advancement of Science [AAAS]). scientific work requires creativity are part of the subject of inclination and are identified as important dimensions of the nature of science. Moore and Foy (1997) developed attitude towards science inventory,(ATSI) Dimensions of the attitudes toward science addressed by the ATSI are at the forefront of interest in the development of a science literate citizen. (Baker, 1985; Finson & Enochs, 1987; LaShier & Nieft, 1975; Welch, 1972) etc has done wok in this direction. (Pajares, 2002; Pajares, & Schunk, 2001). Science educators had also recognized the importance of attitudes toward science in science learning (Blosser, 1984; Koballa, 1995; Schibeci, 1984; Simpson, Koballa, Oliver, & Crawley, 1994). Intuitively, one would assume that attitudes toward science would be positively related to science achievement. Several studies indeed found such positive correlations (House, 1996; Lee & Burkam, 1996; Rennie & Punch, 1991; Simpson & Oliver, 1990). When the literature is investigated, it is seen that there are studies to determine the attitude of students towards science but the studies related to all factors effecting attitudes are limited, the present scale is prepared to investigate the attitude of science in relation to all the factors affecting it in changing need of the society.

### Methodology

In the study, an instrument was developed to define middle school level children attitude towards opting science as a subjects. The instrument development study was realized in the winter semester of 2013 academic year with the participation of 875 CBSE board schools students selected from different schools of Meerut district.

### Sample

The sample of study consists of 875 CBSE board schools students studying in 6-10th grades that are chosen from different schools of Meerut district. Demographic information of the sample was given in Table 1.
Table 1.

<table>
<thead>
<tr>
<th></th>
<th>Frequency (f)</th>
<th>Percentage (%)</th>
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</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>465</td>
<td>53.14</td>
</tr>
<tr>
<td>Female</td>
<td>410</td>
<td>46.86</td>
</tr>
<tr>
<td><strong>Grade</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VI</td>
<td>130</td>
<td>14.85</td>
</tr>
<tr>
<td>VII</td>
<td>135</td>
<td>15.43</td>
</tr>
<tr>
<td>VIII</td>
<td>180</td>
<td>20.57</td>
</tr>
<tr>
<td>IX</td>
<td>210</td>
<td>24</td>
</tr>
<tr>
<td>X</td>
<td>220</td>
<td>25.15</td>
</tr>
<tr>
<td><strong>Intelligence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>129</td>
<td>14.74</td>
</tr>
<tr>
<td>Average</td>
<td>650</td>
<td>74.28</td>
</tr>
<tr>
<td>Low</td>
<td>96</td>
<td>10.98</td>
</tr>
<tr>
<td><strong>SES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>315</td>
<td>42.86</td>
</tr>
<tr>
<td>Average</td>
<td>452</td>
<td>51.65</td>
</tr>
<tr>
<td>Low</td>
<td>108</td>
<td>12.34</td>
</tr>
<tr>
<td><strong>Rural urban</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>310</td>
<td>35.42</td>
</tr>
<tr>
<td>Urban</td>
<td>565</td>
<td>64.57</td>
</tr>
</tbody>
</table>

**Planning for developing attitude scale toward science:**

It was planned with the purpose of measuring the attitude at middle school level’s students. The statement was intended to represent both intellectual and emotional statements. This was representing the universe of content, including all factors affecting attitude towards science.

**Development process:**

It was followed five stages in the development of the scale.

**I Stage:** At the first stage, so many attitude scale were examined in order to determine the statement of scale and how to develop scale. A critical review of changing methodology, school infrastructure, teachers’ competences and family conditions i.e SES, parents’ education etc. has also done to determine the direction of scale. It was carried out by semi structured interview of 40 subject experts to determine the factors which can increase the attitude towards science. After interview was analyzed and dimension of ATS was determine.

**II Stage:** At this stage the construction of items was done .After having specified the nature of items and mode of responses, the statements pertaining to each dimension indicated earlier were prepared. The prepared, item pool consists of 115 statements. There are 88 positive and 27 negative statements in item pool of draft attitude scale. These statements were placed together which seemed to reflect an underlying theme, after deciding an initial item pool was generated 115 items on a five point rating scale such as “strongly disagree”, “disagree”, “undecided”, “agree” and “strongly agree”.

**III Stage:** In the third stage: for the purpose of **content validation**, initial draft of the attitude scale with 115 items
on a five point rating scale was given to a panel of judges, consisted of 4 Science educators, 4 practicing scientist and 4 liberal professor of education psychology and educational measurement and evaluation for taking opinions about whether the selected items were valid items for assessing student’s attitudes toward opting science. The experts were asked to examine items with regard to their relevance purpose of the attitude, content coverage, understandability and consistency among one another. On the basis of expert decision, 25 items were deleted because they are not suitable for students’ level and 6 were modified. As a conclusion, attitude scale consists of 70 positive and 20 negative items on five point rating scale.

IV Stage - In the fourth stage: Having received feedback from expert the final draft of the scale was prepared. As a result of factor analysis, the number of item was reduced to 90. Final draft of the attitude scale with items was administered to 875 CBSE board students form grade 6-10th for calculating validity (particularly construct validity) and reliability of the attitude scale. Student’s responses were entered an excel file created for further analyses.

V Stage- In the last stage: The data collected from 875 CBSE board students were analyzed by means of factor analysis and reliability analysis through the use of SPSS 16. Firstly, it was calculated means and standard deviations of upper 27% (237 students) and lower 27% (237 students) points and t-tests between items’ means of upper 27% and lower 27% points. In addition to the data were subjected to factor analysis with principle component method in order to examine the factor structure behind the attitude scale. The principle components factor analysis was followed by varimax rotation (rotated component matrix). Secondly, reliability analysis was performed for each of the emerged sub-scales and Croanbach alpha correlation coefficients were used. Then, Croanbach alpha correlation coefficients were calculated among these factors.

The responses of the top and bottom group of respondents on the total instruments have been compared on the various subscales to provide validity of ATS. The rational is that if there is a difference between the scores of the top scores and the bottom scores in the favour of the top scores on the various subscales, those subscales contribute to the instrument’s ability to distinguish between those with strong attitude towards science and those with weak attitude towards science. This work indicates that each of the various subscales contributes positively to the total score of the instrument. In developing ATS (Attitude towards science) the dimensions for study are as follows: A. Nature of Science B. Application of science C. Science as Enthusiasm D. Financial aspects E. Influence of parents /family F. Vocational Aspects G. Learning of scientific facts H. Science in Assessment / more grades I. Instruction /Teaching of science J. Influence of Teacher and school

Scoring

The ATS is scored by assigning point values to each of the attitude items, point values are assigned as shown in the

<table>
<thead>
<tr>
<th>Table 2.</th>
<th>Positive item</th>
<th>Negative item</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA (strongly agree)</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>A (Agree)</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>U (Undecided)</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>D (Disagree)</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>SD (Strongly Disagree)</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>
Scale contains 10 subscales decided on the basis of Factors affecting attitudes towards science. Scores for various subscales can be determined by adding a total for positive items and a total for negative items and sum total score of 10 subscales is equal to the total scores entire scales.

The range of the entire scale is (1-5\(\times\)90)=90-450

**Reliability**

Croanbach alpha correlation coefficients were calculated on SPSS 16. A split half reliability coefficient was computed for the entire group of students. Application of the Spearman Brown Correction for split half reliability to the correlation coefficient yields a reliability coefficient of .821, Cronbach alpha reliability coefficient is .781 for this group.

**Norms**

Grade norms for class 6-10th and Percentile norms were established for further interpretation.

**Conclusion**

Rapid changes in technology have affected teaching-learning process. Also technology is the main support for the students learning developments nowadays. The aim of improving educational quality shoes the need to increase student’s attitude towards different subjects. With shifting from the teacher-centered instruction to child-centered instruction, the role, activities, attitudes, reflections of the students become more important concern to overlook the effectiveness instruction. Therefore it is needed to have scale has been tested to students’ attitude towards science in changing era.

In the literature, there are so many attitude scales towards instructional technology, educational technology. But there are not enough attitude scales towards science in recent use of technology.

In this study, the scale was developed. Subsequent to a review of literature and carried out interview with science teachers, composed item pool, validated the item pool across the experts and then initial draft of the instrument was constructed.

According to the results, it must be emphasized that the ATS, which allows researchers to study students’ attitudes towards opting science, was developed. Many of the research conducted in the literature are limited to participants from a single city, but there are many school involved in the study belonging to rural and urban areas.

So, participation from different SES and locality was provided to eliminate errors related to scale. So, the attitudes scale was comprehensive for students. The attitude scale that was developed in this study will fill the gap in the literature related to determining attitudes towards science and technologies. Followed by the additional validation studies; the ATS will serve as a valuable tool for both instructors and researchers to assess Student’s attitudes towards opting science as a subject. Permission to use the ATSS for research purposes may be obtained by writing to the authors.
References


