Factors Affecting Scientific Attitude of IX Grade Students

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Abstract

The present study examined the scientific attitude of IX grade students in relation to their scientific interest, science achievement, intelligence and personality. Sample comprised of 600 students of IX grade students studying in UP board schools in Allahabad city. Scientific attitude questionnaire, scientific interest inventory, general mental ability test, neo-personality questionnaire by K.S. Misra and self-constructed science achievement test (form A) were used to collect data. It was found that scientific attitude in intent as well in action is positively related to scientific interest. Scientific attitude in action is positively related to achievement in science. Scientific attitude in intent and action is not related to intelligence. Scientific attitude in intent and action is positively related to four personality traits namely—planned, inquisitive, motivated and adaptable. Scientific attitude in intent is positively related to two traits namely—analytical and tolerant and negatively related to one trait–pessimist but scientific attitude in action is not related to these personality traits. Scientific attitude in action is positively related to three traits namely-self-sufficient, sociable, independent and divergent but scientific attitude in intent is not related to these traits among students. 'Scientific interest' emerged as the best predictor of scientific attitude in intent as well as action. 'Science achievement' contributes to the prediction of scientific attitude in action. Three personality traits namely; pessimist, tolerant and analytical emerged as the predictors of scientific attitude in intent while planned and alienated traits contributed to the prediction of scientific attitude in action.

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Introduction

Development of scientific attitude is an important goal of science education. According to Klopfer (1971) scientific attitude refers to the 'desirable attitudinal outcomes' which are the professional attributes of the scientist that are displayed in conducting scientific inquiries. Schibeci (1984) suggests that 'scientific attitudes' can be regarded as norms which govern scholarly pursuits. These attitudes represent predispositions appropriate for solving problems in everyday life as well. A person with scientific attitude has actions and thoughts based on his knowledge, suspends reaching conclusions and forming judgments when reliable and objective information is lacking, or until such time as he has the opportunity to study such information (Smith, Krouse and Atkinson, 1967). Scientific attitude has two components—intent and action (Misra, 2008). The intent component represents the students' tendency to show approval or disapproval of behaviours which define a scientific attitude. This is indicated by his endorsement of specific sources of action in certain situations relevant to the scientific attitudes. The action component represents behaviour the student actually demonstrates in the science classroom which defines an attitude.

Research (Gautam, 2000; Pandey, 2006) has shown a positive relationship between scientific attitude and scientific interest. However, Moore (1930) found that there is positive relationship between scientific attitude (in facts) and scientific interest but there is no relationship between scientific attitude (in judgement) and scientific interest. Students with high level scientific interest exhibit higher scientific attitude than their counterparts with low scientific interest (Gautam, 2000).

There exists a positive relationship between scientific attitude and achievement in science (Bhattacharya, 1997; Bileh and Zakhariades, 1975; Ksheersagar and Kavyakishore, 2013; Moore, 1930; Rao, 1990). However, some researchers found no relationship between scientific attitude and achievement in science (Baumel and Berger, 1965; Dhatrak and Wanjari, 2011 and Hoff, 1936). Scientific attitude is found to be the predictor of science achievement (Mukhopadhyay, 2013). Scientific attitude is positively related to intelligence (Fraser, 1977; Kumari, 2000; Shukla, 2010). Scientific attitude-intent is positively related to intelligence but scientific attitude-action is not related to intelligence (Shukla, 2010). Personality traits Q_1 (submissiveness versus dominance) and E (conservatism versus radicalism) were found to be positively

associated with scientific attitude (Rao, 1990). It was found that overall scientific attitude is positively related to personality trait G (expedient versus conscientious); scientific attitude in intent is positively related to personality trait B (more intelligent versus less intelligent); scientific attitude in action is positively related to personality traits G (expedient versus conscientious) and Q4 (tensed versus relaxed) (Pandey, 2006).

The review of the research shows that there is no conclusive evidence about the relationship between scientific attitude and scientific interest. There is no conclusive evidence about the relationship between scientific attitude and achievement in science. Few studies have revealed relationship between overall scientific attitude and achievement in science. Relationship between two components of scientific attitude namely intent and action and achievement in science is yet to be established. Positive relationship between scientific attitude and personality trait like, expedient versus conscientious, more intelligent versus less intelligent, expedient versus conscientious and tensed versus relaxed has been found. Relationship between two components of scientific attitude namely intent and action of scientific attitude and personality traits is yet to be established. The extent to which scientific interest, achievement in science, intelligence and personality contribute to the prediction of scientific attitude is yet to be explored. Relationship of two components of scientific attitude with scientific interest, achievement in science, intelligence and personality needs further exploration. The present study is a humble attempt to study the scientific attitude among students in relation to their scientific interest, achievement in science, intelligence and personality.

Objectives

The objectives of the study are as follows:

- To study the relationship between IX grade students' scientific attitude and scientific interest.
- To study the relationship between IX grade students' scientific attitude and achievement in science.
- To study the relationship between IX grade students' scientific attitude and intelligence.
- To study the relationship between IX grade students' scientific attitude and personality.

- To find out the extent to which scientific interest, achievement in science, intelligence and personality traits contribute to prediction of scientific attitude.

Method

Sample

The population of this study comprises of male and female students studying in Class IX in UP Board schools of Allahabad city. To begin with, the investigator prepared a list of UP Board schools in Allahabad city. Ten schools (five boys and five girls) were randomly selected from different regions of Allahabad city. The researcher then randomly selected two sections of Class IX from each school. 30 students studying in each section were randomly selected for inclusion in the sample. Thus, multistage random sampling was adopted to select the sample for the present study. It consisted of 600 students.

Measures

Scientific attitude of IX grade students was measured by using 'Scientific Attitude Questionnaire' constructed by K.S. Misra (2008). It consisted of 112 items (84 items for measuring intent component and 28 items for measuring action component of scientific attitude). Split–half reliability was estimated to be 0.82 for IX grade students. Validity was established by calculating coefficient of correlation between total and action (r = 0.96) and between total and intent (r = 0.79) parts of scientific attitude.

'Scientific Interest Inventory' constructed by K.S. Misra (2014) was used for measuring scientific interest of students. It contained 49 (five point scale items) items. A score of 1, 2, 3, 4 and 5 for 'very high, high, average, low and very low' responses is given. Test- retest reliability of 'scientific interest inventory' was found to be 0.65 (50 students) and criterion-related validity was found to be 0.84 Kumar (2003).

'Science Achievement Test (Form A)' developed by Srivastava and Misra (2015) was used to measure science achievement of students. It consisted of 50 multiple choice questions which covered all the six chapters of the syllabus prescribed by Madhyamik Shiksha Board, U.P. The reliability for SAT was calculated by split-half method and it was found to be 0.67 (N=200) and parallel form reliability was found to be 0.59 (N=50). Content and criterion related validity were established.

'Verbal Test of General Mental Ability' developed by K.S. Misra (2007) was used for measuring intelligence of students. The test measures verbal intelligence of students studying in Class X, XI and XII. It consisted of multiple choice objective type items belonging to five subtests namely-code transformation test, classification test, numerical reasoning test, analogies test and verbal facility test. A score of 1 is awarded for every correct answer. The value of split half reliability was found to be 0.78 (N= 60) and predictive validity was 0.54 (N= 60) determined against achievement (Misra, 2007). Stanine score norms have been calculated.

Twenty two personality traits namely-planned, crooked, self-sufficient, reticent, egoist, sociable, disturbed, analytical, alienated, hesitant, independent, group dependent, perseverant, rest-loving, dominant, inquisitive, motivated, pessimist, anxious, divergent, adaptable and tolerant were measured using 'Neo-Personality Questionnaire' by K.S. Misra (2012). All the items use a five point scale response format. A score of 5, 4, 3, 2 and 1 awarded to responses namely; 'nearly always, mostly, many times, sometimes, nearly never' respectively. Scores on each of the four questions belonging to each personality trait were added together to find a score for each dimension of the personality trait. Split half reliability calculated for various personality traits ranged between 0.26 to 0.78 (0.69 for planned, 0.78 for crooked, 0.48 for self-sufficient, 0.37 for reticent, 0.39 for egoist, 0.58 for sociable, 0.26 for disturbed, 0.53 for analytical, 0.51 for alienated, 0.66 for hesitant, 0.47 for independent, 0.63 for group-dependent, 0.64 for perseverant, 0.64 for rest-loving, 0.77 for dominant, 0.60 for inquisitive, 0.49 for motivated, 0.72 for pessimist, 0.52 for anxious, 0.65 for divergent, 0.27 for adaptable and 0.64 for tolerant). Factorial validity was determined using varimax rotated factor analysis. Percentile norms have been calculated.

Statistical Analysis

Stepwise multiple regression analysis was used to find out the extent to which scientific interest, achievement in science, intelligence and personality contribute to the prediction of variance in scientific attitude. Product moment coefficients of correlation were computed to find out the relationship between two components of scientific attitude, on the one hand and scientific interest, achievement in science, intelligence and each of twenty-two personality traits, on the other.

Results

Analysis shows that scientific interest was positively correlated with scientific attitude-intent (r=0.17, P<0.01) and scientific attitude-action (r=0.18, P<0.01). Further, achievement in science was positively correlated with scientific attitude-action (r=0.13, P<0.01) but not with scientific attitude-intent (r=0.07, P>0.05). No significant relationship was observed between intelligence and scientific attitude-intent (r=0.05, P<0.05) and scientific attitude-action (r=0.09, P<0.05).

Table 1 shows that out of 22 values of correlation between scientific attitude in intent and various personality traits, two values are significant at 0.05 level and five values are significant at 0.01 level. For scientific attitude in action, seven values of correlation are significant at 0.01 level and one value of correlation is significant at 0.05 level. It means that scientific attitude in intent and action is positively related to planned, inquisitive, motivated and adaptable personality traits. Scientific attitude in intent is positively related to analytical and tolerant personality traits but it is negatively related to pessimist trait. Scientific attitude in action is not related to these personality traits. Scientific attitude in action is positively related to self-sufficient, sociable, independent and divergent traits but scientific attitude in intent is not related to these traits among students. Thirteen values of correlation for thirteen personality traits and both the components of scientific attitude are not significant at 0.05 level. They point to existence of no relationship between scientific attitude in intent and action on one hand and thirteen personality traits namely; crooked, reticent, egoist, disturbed, alienated, group-dependent, hesitant, perseverant, rest-loving, dominant and anxious.

Table 1

Relationship between intent and action components of scientific attitude and personality traits among students

S. No.	Personality Traits	Scientific Attitude-Intent	Scientific Attitude-Action
1.	Planned	0.03**	0.06**
2.	Crooked	−0.05	−0.07
3.	Self-sufficient	0.02	0.09*
4.	Reticent	0.06	0.06
5.	Egoist	−0.07	−0.01

6.	Sociable	0.07	0.02**
7.	Disturbed	−0.06	−0.03
8.	Analytical	0.09*	0.00
9.	Alienated	0.01	0.07
10.	Hesitant	−0.02	−0.01
11.	Independent	0.04	0.11**
12.	Group dependent	−0.05	−0.01
13.	Perseverant	0.02	0.07
14.	Rest-loving	0.01	0.03
15.	Dominant	−0.03	0.02
16.	Inquisitive	0.12**	0.13**
17.	Motivated	0.13**	0.13**
18.	Pessimist	−0.11**	−0.04
19.	Anxious	−0.03	−0.01
20.	Divergent	0.04	0.12**
21.	Adaptable	0.09*	0.12**
22.	Tolerant	0.11**	0.06

* $P<0.05$; ** $P<0.01$

Table 2 shows that scientific interest and three personality traits namely pessimist, tolerant, analytical emerged are the best predictors of scientific attitude-intent. R square value is 0.06. It means that these variables explain 6.0% of the variance in scientific attitude-intent.

Table 2

Results of linear step-wise regression analysis for predicting scientific attitude in intent for students

S. No.	Independent Variables	Beta-Coefficient	Constant	F-ratio	R square
1.	Scientific interest	0.08	39.46	9.85	0.06
2.	Pessimist	−0.63			
3.	Tolerant	0.49			
4.	Analytical	0.26			

Table 3 shows that scientific interest, personality traits planned and alienated and science achievement emerged as the best predictors of scientific attitude-action. R square value is 0.06. It means that these variables explain 6.0% of the variance in scientific attitude-action.

Table 3

Results of linear step-wise regression analysis for predicting scientific attitude in action for students

S. No.	Independent Variables	Beta-Coefficient	Constant	F-ratio	R square
1.	Scientific interest	0.02	10.15	9.96	0.06
2.	Planned	0.17			
3.	Alienated	0.17			
4.	Science Achievement	0.06			

Discussion

The findings of the study revealed that scientific interest is positively related to scientific attitude in intent as well as action among students. It also emerged as a predictor of scientific attitude. It seems that learning opportunities provided in science classroom encourage the use of scientific interest to develop scientific attitude in intent as well action. These findings are consistent to the findings of Gautam (2000) and Pandey (2006) who found that there exist a positive relationship between scientific interest and scientific attitude. However, Moore (1930) found contradictory results that there is positive relationship between scientific attitude (in facts) and scientific interest but there is no relationship between scientific attitude (in judgement) and scientific interest.

A number of studies (Bhattacharya, 1997; Bileh and Zakhariades, 1975; Kaushik, 1998; Ksheersagar and Kavyakishore, 2013; Moore, 1930; Mukhopadhyay, 2013; Rao, 1990; Sharma, 2007; Yadav, 2010) have shown a positive relationship between scientific attitude and achievement in science. However, in the present study it has been found that scientific attitude in action is positively related to achievement in science but scientific attitude in intent is not related to achievement in science. This shows differential impact of achievement in science on the intent and action components of scientific attitude. Nay and Crocker (1971) have suggested that students should also show the evidence

that they accept, prefer and value these attributes, not only they demonstrate these attitudes to satisfy the teacher or to perform better in science. It also contributes to the prediction of science achievement in students.

It has been found in the present study that there is no relationship between scientific attitude in intent/action and intelligence. It suggests that intelligence may not influence scientific attitude–intent and action. Development of scientific attitudes is desirable personal attribute for all to have, no matter what their mental ability is (Gauld, 1976). However, contrary are the findings that scientific attitude is positively related to intelligence (Fraser, 1977; Kumari, 2000; Shukla, 2010). 'Motivated' personality trait is positively related to scientific attitude in intent as well as action. It might be that due to this high motivation, students are more encouraged to learn science to develop their scientific attitude in intent as well as action.

Personality trait 'planned' is positively related to scientific attitude in intent as well as action. It also emerged as a predictor of scientific attitude in action. This indicates that students' disposition to work in an organised and systematic manner might lead to the development of scientific attitude in intent and action among students. There is positive relationship between 'analytical' trait and scientific attitude in intent and action. This indicates that increase in the tendency to examine phenomenon, problems, ideas or behaviour to know about them can promote scientific attitude in intentions as well as actions. It also emerged as a predictor of scientific attitude in intent. 'Inquisitive' personality trait is related to scientific attitude in intent and action among students. It means that inquisitiveness is crucial for promoting intent and action components of scientific attitude among students. 'Adaptability' is positively related to scientific attitude in intent as well as action among students. This means that students' ability to make necessary intrapersonal and interpersonal adjustments increases tendency to act like scientists while confronting the new situations. This finding draws indirect support from the finding that emotional intelligence is positively related to scientific attitude (Jindal, 2014). Trait 'adaptability' seems to be related to emotional intelligence. An emotionally intelligent person usually has better interpersonal and intrapersonal adjustment. Tendency to be 'pessimist' can negatively influence scientific attitude in intent. 'Pessimist' and 'tolerant' are not related to scientific attitude in action but they

emerged as predictors of scientific attitude in action. Self-sufficient, sociable, independent and divergent personality traits positively influence scientific attitude in action but they do not influence scientific attitude in intent among students. 'Alienated' emerged as the predictor of scientific attitude in action. Personality traits crooked, reticent, egoist, disturbed, alienated, hesitant, dominant, group-dependent, perseverant, rest-loving and anxious are not related to scientific attitude in intent as well as action.

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