

SCIENTIFIC ATTITUDE AND GENDER DIFFERENCES IN BIOLOGY

Manoj Kumar Yadav and Vinod Kumar Singh

Faculty of Education, Banaras Hindu University

Varanasi-221010, U.P., India

E-mail: mmonoz9433@gmail.com

E-mail: vksinghgzp@gmail.com

The purpose of this study was to examine the effect of gender on scientific attitude of higher secondary school students in biology. A sample of 300 students, studying in Class XI was chosen from six higher secondary schools of Varanasi city affiliated to CBSE under the administration of either CBSE or Banaras Hindu University. Relevant data were gathered with the help of a tool 'Action - Affection -Thinking Style Questionnaire' (AATSQ) developed by Singh, P. N. (1988). Statistical analysis was made by calculating mean, standard deviation and t-test. The finding of the study indicates that there is no significant difference between scientific attitude of male and female students in biology at formal operational stage.

Key words: *Scientific attitude, biology, formal operational stage.*

Introduction

In all developing countries, science and technology are essential for economic and technological advancement and much attention is given to the teaching, learning and achievement in science subjects, such as, biology, chemistry, mathematics and physics.

Taking cognizance of the importance of science and technology, especially in science subjects, such as, biology is taught in higher secondary schools here to prepare a base for any scientific and technological development.

Biology is one of the subjects which is very important in the well-being of a nation since without knowledge in biology, individuals will not become doctor, radiographers, human physiologists, biochemists, scientists, etc.

For the achievement in biology, students have to develop their cognitive abilities with the help of learning experiences provided by the teachers. For this, the development of

scientific attitude is necessary. Today, science is not only conceived as a systematised body of knowledge, but scientific method and scientific attitudes are also supposed to be its important components.

Rationale of the Study

The advancement of technology depends upon the emergence of the scientific knowledge, methods and attitudes. It provides opportunities to develop all intellectual abilities like sense of meaningful observation, facts, reasoning and purposeful thinking among students.

Inculcating the scientific attitudes and developing problem solving abilities are major objectives of science teaching. But our young boys and girls are being alienated from science subjects on a large scale for which they continue to be deprived of the acquisition of scientific attitudes (Johnson, 2006).

Research on science education shows a declining trend in the number of students

pursuing education in science and science related fields. But individual interest in science education is very important for learning sciences. The scientific attitudes have an effect upon student's selection of different subjects and also on their interest and achievement in the scientific knowledge (George, 2000).

It helps in developing scientific mind which is *sine qua non* for achievement in science. It relates human life with the total environment in general. It is a disposition towards a certain object or person, which is based on judgement of facts. It is prompted by actual and factual states of conditions in which we do not employ our emotional and sentimental considerations. Keeping in mind the vision for the advancement of science and technology, the educationists, biologists and policy makers have emphasised the need of scientific attitudes so that the learners may contribute in national development.

Scientific Attitude and Gender

Gender issues have been a major focus of science education. Research has shown that boys have more positive attitude than the girls, as well as higher achievement scores (Rosier and Barkis, 1990). Over twice as many boys have future interest in science than girls (Catasambis, 1995). The same results of females having a less positive attitude toward science than males are found in many studies (George, 2000). Also, Raimi and Adeoye's (2002) findings reveal that there is a significant difference between males and females in terms of their attitude towards integrated science in favour of males.

Research studies have identified a number of factors influencing students' attitudes

towards science in general. These can be broadly defined as gender, personality, structural and curriculum variables. Of these the most significant is gender for, as Gardner (1995) argued, sex is probably the most significant variable related towards pupil's attitude to science. This view is supported by Schibeci (1984) in his extensive review of the literature, and more recent meta-analysis of a range of research studies by Weinburgh (1995) covering the literature between 1970 and 1991. The summarised numerous research studies to show that boys have a consistently more positive attitude to school science than girls, though this effect is stronger in physics than in biology. Thus, it is clear from an extensive literature on the subject, mainly as a result of a serious consideration and investigation of the problem in the 1980s, is that girls' attitudes to science are significantly less positive than boys' (Hendley, et al., 1996; Breakwell and Beardsell, 1992; Erickson and Erickson, 1984; Harding, 1983; Harvey and Edwards, 1980; Johnson, 1987; Kahle and Lakes, 1983; Smail and Kelly, 1984). More recent studies have been undertaken by Jones, et al. (2000) and Sjoberg, (2000) using questionnaires with large samples which have also supported this finding.

Thus, a series of review of the related studies on gender differences provides contrasting findings. However, the factors behind these differences are not clear. Hence, gender differences on scientific attitude require further study, especially within an Indian classroom. Here, the investigator has taken the sample at formal operational stage of Piaget, et al., 1960.

The present study takes supposition that there is effect of gender on scientific attitude in biology among higher secondary school students in India.

Research Question

The following research question was in mind of the investigator while dealing with the problem:

Is there any effect of gender on formation of scientific attitude in biology?

Operational Definition of the Term

Scientific attitude: In the present study, scientific attitude has been defined in terms of the following six components:

(1) *Rationality*

- (i) Tendency to test traditional beliefs.
- (ii) Seeking for natural causes of event and identification for cause-effect relationship.
- (iii) Acceptance of criticism.
- (iv) Challenge of authority.

(2) *Curiosity*

- (i) Desire for understanding new situations that are not explained by the existing body of knowledge.
- (ii) Seeking to find out the 'why', 'what', and 'how' of an observed phenomenon.
- (iii) Giving emphasis on the questioning approach for novel situations.
- (iv) Desire for completeness of knowledge.

(3) *Open-mindedness*

- (i) Willing to revise opinions and conclusions.

- (ii) Desire for new things and ideas.
- (iii) Rejection of singular and rigid approach to people, things and ideas.

(4) *Aversion to Superstitions*

- (i) Rejection of superstitious beliefs.
- (ii) Acceptance of scientific facts and explanations.

(5) *Objectivity*

- (i) Observation free from personal judgement.
- (ii) Interpretation without making any modification in present social, economic and political conditions.

(6) *Suspended Judgement*

- (i) Unwilling to draw inference before evidence is collected.
- (ii) Unwilling to accept things and facts that are not supported by convincing proof.
- (iii) Avoiding quick judgment and confusion.

Objective of the Study

The main objective of the study was as follows:

To find out the effect of gender on the scientific attitude in biology of Class XI students.

Research Hypothesis

The following hypothesis was framed for the present research study:

HR1: There is a difference between scientific attitudes in biology of male and female students.

Null Hypothesis

The following null hypothesis was tested at 0.05 level of significance:

Ho1: There is no significant difference between scientific attitude in biology of male and female students.

Method of the Study

The descriptive survey method was used in this research study.

Tool of the Study

Relevant data were gathered with the help of the following tool:

'Action - Affection - Thinking Style Questionnaire' (AATSQ) by Singh, P. N. (1988).

Population of the Study

Students belonging to Class XI biology group of different higher secondary schools affiliated to CBSE and under the administration of either CBSE or Banaras Hindu University of Varanasi city constituted the population of the study.

Sample of the Study

The sample of the present study consisted of 300 students of Class XI of six different higher secondary schools of Varanasi city affiliated to CBSE and under the administration of either CBSE or Banaras Hindu University. Both male and female students were included in the sample. The sample was selected by random sampling technique.

Finding of the Study

The finding of the study in relation to the objective is presented below:

Objective: To find out the effect of gender on scientific attitude in biology of Class XI students.

Hypothesis tested: Hypothesis H01 was tested to meet Objective 1.

Table 1

Mean and S.D. of Total Sample for Data Variables

S. No.	Variable	Mean	S.D.	N
1.	Scientific attitude	68.61	11.34	300

Table 1 shows the mean and standard deviation of total sample (N=300) for data variable.

Table 2

Mean and S.D. of Male Students for Data Variable

S. No.	Variable	Mean	S.D.	N
1.	Scientific attitude	68.62	11.65	202

Table 2 shows the mean and standard deviation of male students (N=202) for data variable.

Table 3

Mean and S.D. of Female Students for Data Variable

S. No.	Variable	Mean	S.D.	N
1.	Scientific attitude	68.61	10.75	98

Table 3 shows the mean and standard deviation of female students (N=98) for data variable.

Effect of Gender on Scientific attitude

To find out the effect of gender on scientific attitude, t-test was used. Mean and S.D. of

Table 4**Significance of the Difference between Mean Scores of Scientific Attitude of Male/Female Students**

S. No.	Gender	N	Mean	S.D.	t-value	L.S.
1.	Male	202	68.62	11.65	0.0073	$p \rightarrow 0.05$
2.	Female	98	68.61	10.75		

Class XI male/female students for scientific attitude scores and results of t-test are given in Table 4.

From Table 4, it is evident that mean scores of male (68.62) and female (68.61) for the scores on scientific attitude do not differ significantly at 0.05 level [t (298) = 1.97, $p < 0.05$]. Therefore, the null hypothesis that there is no significant difference between scientific attitude of male and female students is not rejected.

Discussion

The result of this study showed that there is no statistically significant difference between scientific attitude of male and female students in biology at the higher secondary stage. From the review of the related studies, it has been found that gender is one of the important factors that influence scientific attitude at formal operational stage (Colley, et al., 1994; Francis and Greer, 1999 and Joyce and Farenga, 2000). But these findings are not significant in this study.

Conclusion

It has now been demonstrated conclusively that social and economic development of a country is closely linked to the educational level of its female population (UNESCO, 2005). It is evident from the findings of the study that no gender disparity exists in the scientific attitude of male and female students in biology of higher secondary school students. This implies that scientific attitude in biology is free from gender bias.

Recommendation

Indian society is traditionally religious in nature. Its material progress can be achieved only by developing scientific attitude among its citizens. For this, the study of scientific attitude and other relevant variables is necessary. The problem of the present study itself is an area which needs thorough evaluation and careful probing. Schools run by state governments may be included in the study. Further a comparative study of both may be conducted.

References

- BREAKWELL, G. M., AND S. BEARDSSELL. 1992. Gender, Parental and Peer Influences Upon Science Attitudes and Activities. *Public Understanding of Science*. Vol. 1, No. 2. pp. 183–197.
- CATASAMBIS, S. 1995. Gender, Race, Ethnicity and Science Education in Middle Grades. *Journal of Researcher in Science Teaching*. Vol. 32, No. 3. pp. 243–257.
- COLLEY, A., C. COMBER AND D. HARGREAVES. 1994. School Subject Preference of Pupils in Single Sex and Co-educational Secondary Schools. *Educational Studies*. Vol. 20, No. 3. pp. 379–386.
- ERICKSON, G., AND L. ERICKSON. 1984. Females and Science Achievement: Evidence, Explanations and Implications. *Science Education*. Vol. 68, pp. 63–89.
- FRANCIS, LESLIE J. AND JOHAN E. GREER. 1999. Attitude Toward Science Among Secondary School Pupils in Northern Ireland: Relationship with Sex, Age and Religion. *Research in Science and Technological Education*. Vol. 17, No. 1. pp. 67–74.
- GARDNER, P. L. 1995. Measuring Attitudes to Science. *Research in Science Education*. Vol. 25, No. 3. pp. 283–289.
- GEORGE, R. 2000. Measuring Change in Students Attitude towards Science Overtime. *Journal of Science Education and Technology*. Vol. 9, No. 3. pp. 213–225.
- HARDING, J. 1983. *Switched Off: The Science Education of Girls*. Longman, New York.
- HARVEY, T. J., AND P. EDWARDS. 1980. Children's Expectations and Realisations of Science. *British Journal of Educational Psychology*, Vol. 50, pp. 74–76.
- HENDLEY, D., S. STABLES AND A. STABLES. 1996. Pupils' Subject Preferences at Key Stage 3 in South Wales. *Educational Studies*. Vol. 22, No. 2. pp. 177–187.
- JOHNSON, S. 1987. Gender Differences in Science: Parallels in Interest, Experience and Performance. *International Journal of Science Education*. Vol. 9, No. 4. pp. 467–481.
- JONES, G., AND HOWE, A. ET AL. 2000. 'Gender Differences in Students' Experiences, Interests and Attitudes towards Science and Scientists. *Science Education*. Vol. 84, No. 2. pp. 180–192.
- JOYCE, B.A., AND S. J. FARENGA, 2000. Young Girls in Science: Academic Ability, Perceptions and Future Participation in Science. *Roeper Review*. Vol. 22, No. 4. pp. 261–262.
- KAHLE, J.B., AND M. K. LAKES, 1983. The Myth of Equality in Science Classrooms. *Journal of Research in Science Teaching*. Vol. 20, pp. 131–140.
- PIAGET, J., B. INHEDER AND A. SZEMIRAKA. 1960. *The Child Conceptions of Geometry*. Basic Books, New York.

R. A. SCHIBECI. 1984. Attitudes to Science: An Update. *Studies in Science Education*. Vol. 11, pp. 26–59.

RAIMI, S. A., AND , F. A. ADEOYE. 2002. Gender Differences among College Students as Determinant of Performance in Integrated Science. *African Journal of Educational Research*. Vol. 8, No. 1&2. pp. 41–49.

ROSIER, M. J., AND D. K. BARKIS. 1990. The Scientific Literacy of Australian Students: Science Achievement of Students in Australian Primary and Lower Secondary. Australian Council for Educational Research. *Research Monograph*. Vol. 39. Hawthorn, Victoria.

SINGH, P. N. 1988. Construction and Standardisation of a Test of Scientific Attitude. Ph.D. Thesis in Education, BHU, Varanasi, India.

SJOBERG, S. 2000. Interesting all Children in 'Science for all'. In R. Millar, J. Leach, & J. F. Osborne (Eds.). *Improving Science Education*. (pp. 165–186). Buckingham, Open University Press.

SMAIL, B. AND A. KELLY. 1984. Sex Differences in Science and Technology among 11-year-old School children: II - Affective. *Research in Science and Technology Education*. Vol. 2, pp. 87–106.

UNESCO. 2005. *Scaling up Good Practices in Girls' Education*; UNESCO, Paris.

WEINBURGH, M. 1995. Gender Differences in Student Attitudes toward Science: A Meta-analysis of the Literature from 1970 to 1991. *Journal of Research in Science Teaching*. Vol. 32, No. 4. pp. 387–398.