

Project on Achievement in Life Science: It's Relationship with Aptitude in Life Science & Scientific Attitude -An Investigation

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I. INTRODUCTION

Education on all accounts is accepted to be a systematic and applied discipline. It is systematic because it draws heavily upon other disciplines. It is applied because educational ideas have to be practiced before they could gain proper acknowledgment and accuracy. It raises the status of the human beings and the community as a whole. It broadens the mental horizon of the human beings. Education involves the transfer of communication of information, knowledge and skills from one point (The Source) to another (The Receiver).

Education is universally recognized as the most effective tool of bringing about the change towards the social and economic betterment and cultural transformation of a society. It broadens the mental horizon of the human being. In one hand, education develops the total personality of an individual; on the other hand it contributes to the growth and development of the society. It is only through education, the moral ideas and spiritual values, the aspiration of the nation and its cultural heritage are transferred from one generation to another for preservation, purification and sublimation into higher and higher culture. Education is the key to all processes of development especially human development.

Science is the part of educational system which plays a pivotal role to make a man rational, and develop his independent thinking that helps in removing the superstitions in various forms.

An understanding of science will be vital as the next generation of global citizens confronts complex problems such as climate change, sustainable energy, food production and the control of diseases and illness. Indeed, the role of educational system in the future is not only to prepare the next generation of scientists, but also to produce an informed citizenry, capable of understanding and using the scientific evidences to form their opinions and choices.

Achievement is the end product of all educational endeavors. The main concern of all educational efforts is to see that the learner achieves. Quality control, quality assurance and total quality management of achievement have increasingly gained the attention of research in education. After exploring the concept of achievement in the cognitive, affective and psychomotor aspects of human behaviour, researchers have proved further and have attempted to understand the "black box" of achievement.

Achievement in science of a learner is the resultant of learning experiences of various kinds. It is a product variable and is influenced by several independent variables (Rao, 1996), which are obviously the determinants of effective science learning. The factors like scientific aptitude and scientific attitude are few among the major aspects to qualify an individual to live as an effective citizen in the present scientific society.

Scientific attitude is the most important outcome of science teaching. Thurston has used the concept of attitude as the sum total of man's inclinations and feelings, prejudice, or bias, pre-conceived notions, ideas, threats and convictions about any specific topic. Attitudes are developed, they are not inborn. They can be changed or modified over the time. Such an attitude is also noticed in the field of science, which we consider as "**scientific attitude**". Here, the scientific attitude means one's inclination or readiness of mind towards the pursuit of scientific knowledge. This scientific attitude sometimes interchanged with scientific temper. This temperament is a tendency of an individual who is very much inclined to learn scientific concepts. Scientific attitude is the part of the attitude and this is the second value monopolized by science, which is transferable. These attitudes of a scientist involve critical observation, open-mindedness, suspended judgments, free from superstitions and false belief etc.

Learning significantly depends on the unique traits and abilities of a learner determining their characteristics. Aptitude in Life Science and scientific attitude are few among these important factors, upon which Life Science learning depends to a great extent. **Aptitude** in Life Science helps a learner to apply skill and competency in learning science successfully and indicates the possibility of future accomplishment in the field of learning Life Science. Proper scientific attitude inclines a learner towards scientific knowledge, a scientific process, eminent scientists, and towards scientific inventions encouraging learners' spirit of scientific enquiry.

Therefore, **scientific aptitude**, and **scientific attitude** are two important factors which may influence effective Life Science learning and may also be the determinants of **scientific achievement**.

II. REVIEW OF LITERATURE

Academic achievement in sciences has been investigated by researchers in relation to various correlations, among which aptitude and attitude in science have been considered by number of researchers.

A great number of studies demonstrate that there are associations between students' scientific attitude and achievement in science. For instance, Alexander (1995) found that achievement in science has direct influence on students' scientific attitude. Singh (1988) proposed that scientific attitude can be divided in three components namely cognitive, affective and psychomotor. Bhattacharya (1997) reported that all the three domains of scientific attitude were found having highly positive relation with students' science achievement. There exists a positive relationship between scientific attitude and achievement in science (Ksheersagar, 2013; Mukhopadhyay, 2011.; Sharma, 2007; Bhattacharya, 1997; Paulose, 1992; Bileh & Zakhariades, 1975; Moore, 1930). Findings of Srivastava (2002), Shinde (1982) revealed that students with high achievement in science exhibit higher scientific attitude than their counterparts with low achievement. Science achievement is found to be the predictor of scientific attitude (Bhattacharya, 1997; Alexander, 1995). In contrary to these findings, studies also revealed that there is no relationship between students' scientific attitude and their science achievement.

Dhatrak & Wanjari (2011), Baumel & Berger (1965) and Hoff (1936) found no relationship between scientific attitude and achievement in science. Students with high, moderate and low level of achievement in science do not differ in their scientific attitude (Sharma, 2007; Baumel & Berger, 1965; Hoff, 1936). Gender differences in the relationship between students' scientific attitude and achievement in science are emphasized by the studies of Shinde (1982) and Sharma (2007). Sharma (2007) and Shinde (1982) found that girls showed a better relationship between scientific attitude and achievement in science than boys.

Alexander (1990) has studied the influence of critical thinking, scientific aptitude and socio-economic status on achievement in science of secondary students and found that all these two factors contributed significantly to the achievement in Science. Rao (1996) investigated the relationship among scientific attitude, scientific aptitude and achievement in Biology of secondary students. Kerala University Scientific Aptitude Test constructed by Nair et. al (1968) and Scientific Attitude Scale (Sood and sanadhya, 1979) were used as **tools**. Aptitude, Attitude and Achievement were found to be significantly related to one another.

Kar (2004) found significant and positive association between attitude and achievement in general science. The studies by Pillai (2002), Joseph (1999), Nair and Joseph (2003), SreeKumar (2000) and Sudha (2004) revealed the positive influence of scientific aptitude on science achievement.

Derek Cheung (2009) examined the interaction effect between grade level and gender with respect to students' attitude towards Chemistry lessons taught in secondary schools. The **sample** consisted of 954 Chemistry students in grade secondary 4-7 (approximately 16-19 years of age) in Hong Kong. Students' attitudes were surveyed using an "Attitude Towards Chemistry Lessons Scale (ATCLD)". Male students in secondary 4 and 5 liked Chemistry theory lessons more than their female counterparts. However, male students' liking for Chemistry laboratory work declined when they progressed from secondary 4 to secondary 7; no such significant decline in attitude toward Chemistry laboratory work was found in females. Overall, both males and females were just marginally positive about Chemistry lessons during the years of secondary schooling.

Hensley Clementine, Elizabeth Barber (1987) investigated that boys consistently scored lower than girls. Sarkar (1983), also supported that female scored higher than boys. Wing and Staver (1997) in the study "An empirical study of gender Differences in Chinese students' science achievement", found that boys scored higher than girls.

Melkonion, Michael (1997) conducted a study to know the effect of gender on science achievement level found that, generally female students attained significantly higher grades than their male counterparts. Manning, M. Lee (1998) and Pinchas Tamir (1998) supported that boys like to study math and science than female and achieve high score in science. Leader (1992) has also reported the existence of gender differences in science subjects in general as well as in Mathematics.

Significance of the Study

Life Science is one of the important disciplines in science, particularly for the learners at secondary stage. Sound achievement in Life Science is essential for individual development as well as for socio-economic development of the country in this competitive world.

Studies therefore indicate that scientific attitude and scientific aptitude might be the factors which account for students' achievement in science. Research investigations have been conducted to study the relationship of scientific achievement with the two factors as mentioned, considering each of the factor separately or together. Neither of the studies investigates scientific achievement in relation to these two factors considering them together in the field of Life Science. Achievement in Science may depend upon Aptitude in Science, Scientific attitude but study has yet to be reported to investigate the nature of the said relationship in the field of Life Science. Hence, is the significance of such investigation.

Formulation of Research Questions

Following problems have arisen during the investigation. The two major research questions were investigated are:

1. How is the relationship of achievement in Life Science with scientific attitude and how is the relationship of the same with aptitude in Life Science?
2. Is there any significant gender influence on students' achievement in Life Science?

Objectives

Every research project deals with the solution of a problem of human interest. Therefore, the researcher has a definite purpose in mind. There are certain specific goals to achieve through this research work. Such specific goals or purposes are technically formed as objectives. Every research study must have same objectives to achieve, without which no research can be conducted. The entire research process is guided by objectives which have been explicitly and precisely spelled out by the investigator in advance.

The present study was aimed at achieving the following objectives:

- 1) To investigate the relationship of achievement in Life Science with aptitude.
- 2) To investigate the relationship of achievement in Life Science with scientific attitude.
- 3) To investigate whether there lies any significant intergroup difference in achievement in Life Science due to gender.

Hypotheses

Hypotheses are formulated according to the objectives, as stated. These are expressed in forms of null hypotheses in view of inadequate number of related findings.

Hypotheses of this investigation are as follows:

H01: There is no significant co-relation of achievement in Life Science with each of the factors i.e. Aptitude in Life Science and Scientific Attitude (at bivariate level)

H02: There is no significant difference in students' achievement in Life Science between boys and girls.

III. METHODOLOGY

POPULATION: The population of this study was comprised of Secondary students in North 24 Parganas of West Bengal.

SAMPLE: Students of class X, studying Life Science in 3 different schools of Barrackpore, West Bengal (under W.B.B.S.E.) constituted the Sample (N=345). Sub-urban schools were selected for collecting data and the sample consisted of both boys and girls. Stratified and random sampling techniques were used for the selection of the schools.

Operational Description of Selected Variables:

A. Achievement in Life Science: In the present context, achievement in Life Science has been described operationally in terms of students' scores in Life Science in the annual examination of class IX (under W.B.B.S.E.).

B. Aptitude in Life Science: Aptitude in Life Science is described operationally in relation to three primary abilities, namely: scientific information, vocabulary in Life Science, Verbal comprehension and Interpretation.

C. Scientific Attitude: In the present study, scientific attitude is described operationally in terms of the following characteristics of a person: Rationality, Curiosity, Open-mindedness, Aversion to suspension, Objectivity to Intellectual belief and Suspended judgement.

TOOLS: i) A test on Aptitude in Life Science (constructed by the researcher).

ii) Scientific Attitude scale (TOSRA-TEST OF SCIENCE-RELATED ATTITUDES, Barry J. Fraser) to be adopted by the investigator.

iii) Scores in Life Science of class IX annual examination (Test prepared by W.B.B.S.E., which is as good as a standardized test).

RESEARCH DESIGN: Survey method is adopted by the investigator.

SCORING PROCEDURE: The scientific attitude scale contains 70 items. Among 70 items, 35 are positive and the rest are negative. Positive items of the scale are assigned a weight ranging from 5 (SA: strongly agree) to 1 (SD: strongly disagree) in case of 35 negative items, the scale scoring is reversed, ranging from 1 (SA: strongly agree) to 5 (SD: strongly disagree).

IV. RESULT OF DATA ANALYSIS AND DISCUSSION

AS PER HYPOTHESES

Following steps were used for analyzing the data,

- a) Descriptive Analysis (Mean, Standard Deviation, t-test)
- b) Coefficients of Correlation.

These are discussed step by step as follows,

a) DESCRIPTIVE ANALYSIS (MEAN, STANDARD DEVIATION, t-TEST) :

Mean and Standard Deviation (S.D.) of the scores on each of the selected variables were estimated (in order to investigate sample primarily). These are presented in Table 1, as follows.

Table-1. Mean and Standard Deviation (S.D.) of scores for each of the selected variables (N=345)

V	A	R	I	A	B	L	E	S	M e a n	S . D .	
A	c	h	i	e	v	e	m	e	n	t	6 4 . 5 5
A	p	t	i	t	u	d	e	i	n	L i f e S c i e n c e	1 1 . 2 6
A	p	t	i	t	u	d	e	i	n	L i f e S c i e n c e	3 6 . 4 8
S	c	i	e	n	t	i	f	i	c	A t t i t u d e	1 0 2 . 2 2
										1 0 . 5 8	

Table-2. t-test : Intergroup Difference in Achievement in Life Science due to Gender

G e n d e r	B O Y (N ₁ = 2 0 0)	G I R L (N ₂ = 1 4 5)
M E A N S C O R E S	M ₁ = 7 7 . 4 4	M ₂ = 4 6 . 7 7
S . D .	1 1 . 2 6	1 1 . 2 6
t	4 . 5	2 * *

** Significant at 0.01 level

Data analysis is performed on computer with SPSS 17 software package. When data was analyzed to make a comparative study of the achievement in Life Science of male and female students (Table-2), the result shows a significant difference between achievement in Life Science of males and female (df = 343, t=4.52). The total numbers of male and female students were 200 and 145 respectively as indicated in the Table-2. The mean achievement score in Life Science of male students is 77.44 and the Standard Deviation is 11.26. In case of female students, the mean Life Science achievement score is 46.77 and Standard Deviation is 11.26. The statistically calculated t-value is 4.52; which is significant at 0.01 level with 343 degree of freedom. The result clearly indicates that there is significant difference between mean Life Science achievement score of male and female secondary school students. Both are not equally good and they differ in their Life Science achievement. Thus, the hypothesis of the study (H₀₂) that, “**there is no significant difference between male and female students in Life Science achievement**” is rejected at 0.01 level of significance.

b) Coefficients of Correlation:

Coefficients of correlation of achievement in Life Science with each of the other variables were computed using Pearson's product moment method. Coefficients were estimated over entire sample. Following table (Table-3) shows the results.

Table-3. Coefficients of correlation of Achievement in Life Science with other variables (N=343)

V	A	R	I	A	B	L	E	S	r		
A	c	h	i	e	v	e	m	e	n	t	0 . 6 8 9 N . S .
A	c	h	i	e	v	e	m	e	n	t	0 . 5 6 8 * *
A	c	h	i	e	v	e	m	e	n	t	0 . 5 6 8 * *

** -Significant at 0.01 level ; N.S.-No Significance.

Results reveal that all the coefficients are significant and positive. Coefficients are significant at 0.01 level in case of the correlation of achievement in Life Science with scientific attitude. In view of this result of significant coefficients of correlation, hypothesis H₀₁, “**there is no significant correlation of achievement in Life Science with each of the factors i.e. Aptitude in Life Science and Scientific Attitude**” is rejected and the alternative hypothesis that “achievement in Life Science is significantly correlated with these factors” is accepted.

V. DISCUSSION OF RESULTS

Results indicate that achievement in Life Science is most strongly correlated with Aptitude in Life Science. Aptitude in Life Science implies the possibility of a learner in acquiring skills and competency in learning Life Science. The present study has considered aptitude in Life Science in relation to different primary mental abilities (verbal comprehension, scientific information and vocabulary). These abilities also help learners

in developing their fundamental concepts in leading to their sound achievement in Life Science ultimately. This might account for the result of strong association.

Science in general and Life Science in particular is a process, as well as a product. For proper understanding of Life Science, learners need to apply his/her ability of utilizing knowledge of available facts and information. Learner might also utilize his/her skills and competency in applying various steps of a scientific process in search of the solution of different problems in Life Science. The first one refers to his/her product skill and the second one corresponds to his/her process skill. Therefore, learners' strong orientation towards both process and product ensures the possibility of his/her sound achievement in Life Science.

Therefore, aptitude might encourage learners' process and product skill both, which are also essential for learning Life Science successfully leading to high achievement. This might account for the result of strong prediction of achievement by aptitude.

Scientific attitude is also found to be strongly associated with achievement in Life Science, at bivariate level. Different dimensions of scientific attitude was considered in the present study might be associated with various steps of a scientific process followed by a learner in learning Life Science successfully. The dimension "curiosity", i.e. desire for understanding new situation, is close to learners' sensitivity to problems, encouraging his/her scientific enquiry. The dimension "suspended judgement" i.e. unwillingness to infer before adequate proof, is close, to learners' strong urge for scientific experimentation. These are also essential for learning Life Science leading to sound achievement. This might account for the result of strong association, as found.

Another purpose of the present research was to determine the intergroup difference in achievement in Life Science due to gender on Life Science among secondary schools students. Data from a sample of class X students were analyzed. Results of t-test were used to determine the effects of variables on science achievement. The results of the analysis of data showed that there is a difference. There was a significant difference in Life Science achievement scores between boys and girls in the present study.

VI. CONCLUSION

Primary objective of present work was to investigate Achievement in Life Science is relation to Aptitude is Life Science and Scientific attitude. The results showed that the selected factors are related to achievement significantly at bivariate level. Among these, aptitude in Life Science and scientific attitude are found to be the strong predictors (through significance).

Results also indicate the difference in achievement in the group of male and female learners. The results indicate some particular trends of achieving learners in Life Science. Their learning emphasizes on inter-relating ideas in Life Science. They have sense of logic and preferences of finding fact before concluding anything. They are also oriented towards learning science and have potential to accomplish success in future life in learning Life Science. To some extent they have meaningful orientation in Life Science learning but in spite of this they might not have enough scope to appreciate the beauty in learning Life Science and as a consequence, they fail to enjoy this learning being motivated. Their spirit of scientific enquiry and urge for knowledge construction might not be properly encouraged in the Life Science classroom which is highly controlled by the teachers. Overloaded curriculum undue emphasis of achievement in examination without due concern to proper understanding and moreover inadequate exposure is learning Life Science, particularly may be the probable causes which might motivate them to feel the strong urge for learning Life Science for the sake of learning itself and also discourage them from active participation is learning the same.

VII. DELIMITATIONS

It is not possible in a single research study to cover every aspect of variables associated with the problem under investigation. Although, the problem is very natural and is prevalent everywhere, yet due to shortage of time and resources all the aspects variables could not be covered and the study is limited is several ways. It had to be determined in terms of population covered, sample selected, scope of variables studied, scope of generalization, ability of finding and so on.

- Due to shortage of time and resources, the study was carried out only on students of class X. Although problem of achievement is common to elementary classes yet the focus of the study has been on the secondary stage only.
- The sample was restricted to sub-urban areas of North 24 Parganas only so as to make an in-depth study of the factors that affect achievement in Life Science in these schools.
- The phenomenon of achievement has been studied in relation to selected personal, environmental and institutional variables only.
- The tool for the assessment of the aptitude in Life Science is developed by investigator herself. Although the attempt has been made for proper item selection, tryout, estimation of reliability and validity of the tool, detailed norms still remain to be prepared.

- It is desirable that the researcher reaches first hand or original sources for the study, but as access to some material was not possible, materials taken from available secondary sources has been used.

VIII. SUGGESTIONS FOR FURTHER RESEARCH

Due to the shortage of time and cost in the study, all the variables related to the topic could not be considered. Therefore, there is a broader chance for further research on this topic. These are,

- This study did not address how to bring about the practices to enhance the achievement in Life Science depending upon the variables like scientific attitude and aptitude.
- Further studies on this topic need to be carried out, comparing the results in urban, Sub-urban and rural schools.
- Another such investigation can be made to find out the difference in achievement of the students in Life Science from private and government schools.
- Further research on this topic need to be carried out comparing the students' achievement from schools of different medium of instruction.

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