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INTRODUCTION

The 21st century is considered as the age of learning. Therefore, it is high time to focus on some progressive steps which would be able to awaken curiosity, Interest and Attitude towards Learning amongst the learners. But the present teaching learning process, to certain extend is seen towards rote memory without providing proper practical knowledge. As such the students are not motivated to learn systematically. Hence, steps have to be taken to improve systematic learning of various subjects, especially science because the heart and soul of educational process is science.

Science is considered as an intellectual endeavour which consists of two parts viz., process and product. The 'product approach' implies the way of transferring knowledge established by the scientists to the students whereas 'process approach' stressed by Robert. M. Gagne (1985) includes the way scientists think and do when they solve any scientific problems. The process approach includes hypothesizing, observing, designing experiments, recording, analysing data, informing etc. In addition to all this, it consists of an awareness of the values underlying science.

Thus learning of science may be amenable for development of the
skills related to process of science along with products i.e., scientific knowledge. This is possible only by involving the students in manipulation, observation, exploration, experimentation, interpretation, prediction etc. in science classes. Unless the students are involved in using processes of science during gathering of knowledge, their learning of science remains incomplete. Therefore, science instruction in our classrooms should be more activity oriented, instead of a theoretical one which might hamper student’s Attitude towards Science and Interest in Science.

Eventhough the process method of learning science has been implemented in our schools, the scholastic achievement of the learners has not been seen considerably improved due to various reasons. This may be due to certain gaps existing between theories and practice or lack of interest, aptitude and attitude on the part of the students or may be due to the socio-familial variations of the pupils. Various empirical studies have been seen attempted so far on different psychological factors, but nobody has studied the dominant factors responsible for the scholastic achievement in science, especially Biology. Hence it is proposed to investigate with a view to identify the factors responsible for the scholastic Achievement in Biology. Such a study will be helpful to predict the future performance of students in the learning of science, especially, Biology.

Moreover, being a Biology teacher and teacher educator for the last four years, the investigator has opportunities to observe that majority of the
pupils who are talented in science is not seen scored high marks in science, especially Biology. This may be due to various reasons. Hence the investigator proposed to conduct a study to identify the contributing factors which helps in the scoring of higher marks in Biology. The investigator earnestly believe that the findings thus emerged will be highly useful and beneficial to educationists, planners and administrators, while framing curriculum in science subjects especially Biology in future.

OBJECTIVES OF THE STUDY

1) To examine the significant effect of each select correlates on Achievement in Biology among secondary school pupils, for the Total and Subsamples viz., Sex, Locale and Type of Management.

2) To find out the relationship of each select correlates with Achievement in Biology among secondary school pupils separately for the Total and Subsamples.

3) To identify the most significant correlates for predicting Achievement in Biology among secondary school pupils.

HYPOTHESES

Based on the objectives the hypotheses formulated for the study were as follows:

1) There will be significant effect of each select correlates on Achievement in Biology among secondary school pupils.
2) There will be significant difference in the relationship of each select correlates with Achievement in Biology among secondary school pupils.

3) There will be most significant correlates for predicting Achievement in Biology among secondary school pupils.

METHODOLOGY

The present study is a descriptive survey which includes two types of variables viz.,

1) Dependent variable

2) Independent variables.

As one of the major objectives of the study is to identify the psychological variables which are capable of predicting significant Achievement in Biology, the dependent variable of the study is Achievement in Biology.

In the present study, Scholastic Achievement in Biology is considered as dependent variable.

The independent variables used are:

1) Science Aptitude
2) Attitude Towards Science
3) Science Interest
4) Intelligence
5) Socio-Economic Status
After fixing the sample, adequate copies of the tools and response sheets were got printed. Then a schedule for administering the tool was prepared by visiting the Heads of the proposed schools. As there were six tools to be administered for measuring the variables, the investigator had to get to each school twice for administering the tools.

The question booklets and the response sheets were distributed to the pupils as sets one after one. Time limits were strictly kept wherever necessary. All the test materials and response sheets were collected back after the due time.

Response Sheets of six tools were then scored using the scoring scheme of each item. All the test scores were then consolidated incorporating student's personal data. The data was so entered and consolidated as to facilitate statistical analyses by means of computer.

**PROCEDURE**

**SAMPLE**

The study was conducted on a sample of 600 secondary school pupils drawn from five different districts of Kerala by stratified random sampling method.

**TOOLS**

The tools used were

i) Science Aptitude Test
ii) Scale of Attitude Towards Science

iii) Science Interest Inventory

iv) Verbal Group Test of Intelligence

v) Socio-Economic Status Scale

vi) Achievement Test in Biology for IX Standard Pupils.

Four tools, Science Aptitude Test, Scale of Attitude Towards Science, Science Interest Inventory and Achievement Test in Biology were prepared and standardized by the investigator with the help of her supervising teacher. Verbal Group Test of Intelligence was developed by Sudheeshkumar, Hameed and Prasanna (1997) to measure the general intelligence ‘g’ of secondary school pupils and the Socio-Economic Status Scale prepared by Kuppuswamy and modified by Pillai was selected to measure the Socio Economic Status of the secondary school pupils with slight modification.

STATISTICAL TECHNIQUES USED

Mean, Median, Mode, Standard Deviation, Skewness and Kurtosis of the distribution of the variables were determined. Normal curve of the Achievement in Biology for the total sample was drawn.

Percentage analysis was carried out to determine the levels of each select correlates of the total sample viz., Science Aptitude, Attitude Towards Science, Science Interest, Intelligence and Socio-Economic Status of Secondary School Pupils.
The significant effects of the groups of some select correlates viz., Science Aptitude, Attitude Towards Science, Science Interest, Intelligence and Socio-Economic Status on the Achievement in Biology for the Total sample and for the Subsamples were examined by One-Way Analysis of Variance.

The relationship between Achievement in Biology and each of the select correlates for the total sample and as well as subsamples were examined by using Karl Pearson's Coefficient of Correlation.

Multiple Linear Regression Analysis was carried out to predict the dependent variable from the set of independent variables.

Multiple Regression Analysis and Analysis of Variance were carried out with the help of computer using 'STATISTICA' software. All other computations were done by the investigator herself.

MAJOR FINDINGS OF THE STUDY

Major findings of the study are listed below:

SECTION ONE

ANALYSIS OF VARIANCE

i) There exists very high significant difference in Achievement in Biology of Total sample, irrespective of the effect of groups of the independent variables., Science Aptitude, Attitude towards Science, Science Interest and Intelligence.
ii) There is no significant difference exists in Achievement in Biology by the groups of Socio-Economic Status.

iii) There is high significant difference in Achievement in Biology by the effects of the groups of some select correlates such as Science Aptitude, Attitude towards Science, Science Interest and Intelligence of secondary school pupils in relation to Sex. But there is no significant effect in Achievement in Biology by the groups of Socio-Economic Status.

iv) Groups of Science Aptitude and Attitude Towards Science are significantly influencing the Achievement in Biology of secondary school pupils in respect of Locale of the school (Rural and Urban). There is no difference in Achievement in Biology by the effect of groups of Socio-Economic Status, but the groups of Interest and Intelligence are significantly influencing on Achievement in Biology of secondary school pupils in Urban schools.

v) It is found that groups of almost all select correlates, Science Aptitude, Attitude towards Science, Science Interest and Intelligence are significantly influencing in Achievement in Biology of secondary school pupils based on the Type of Management of the Schools (Private and Government). There is no difference in Achievement in Biology by the effect of groups of Socio-Economic Status.
SECTION TWO

FINDINGS RELATED TO CORRELATIONAL ANALYSIS

a) Results Related to Total Sample

(i) Significant positive relationship exists between almost all select correlates (Science Aptitude, Attitude towards Science, Science Interest and Intelligence) and Achievement in Biology of secondary school pupils.

There is no significant relationship between Socio-Economic Status and Achievement in Biology.

(ii) The population value of coefficients of correlation falls between 0.01 and 0.75 for the Total sample.

(iii) The shared variance between variables was found to be ranging from 0.122 to 6.400

(iv) The predictive efficiency of ‘r’ of the Total sample was ranging from 0.001 to 0.030.

b) Results Related to Subsamples

For Boys

i) There exists significant positive relationship between Science Aptitude, Science Interest, Intelligence and Achievement in Biology (at 0.01 level).
ii) Significant positive relationship, at 0.05 level exists between Attitude towards Science and Achievement in Biology of secondary school pupils.

iii) There is no significant relationship between Socio-Economic Status and Achievement in Biology.

iv) The shared variance between variables was found to be ranging from 0.739 to 8.703.

v) The predictive efficiency of ‘r’ of Boys was ranging from 0.004 to 0.04.

For Girls

i) There exists significant positive relationship between Science Aptitude, Attitude towards Science, Science Interest, Intelligence and Achievement in Biology (at 0.01 level).

ii) There is no significant relationship between Socio-Economic Status and Achievement in Biology.

iii) The shared variance between variables was found to be ranging from 0.270 to 17.556.

iv) The predictive efficiency of ‘r’ of girls was ranging from 0.001 to 0.09.

For Rural School Pupils

i) There is significant positive relationship exists between Science Aptitude, Attitude towards Science, Science Interest, Intelligence and Achievement in Biology at 0.01 level.
There is no significant relationship between Socio-Economic Status and Achievement in Biology.

ii) Population value of coefficient of correlation falls between 0.10 and 0.98.

iii) The shared variance between variables were found to be ranging from 0.883 to 17.892.

iv) The predictive efficiency of ‘r’ were ranging from 0.004 to 0.09.

For Urban School Pupils

i) There exists significant positive relationship between Science Aptitude, Attitude towards Science, Intelligence and Achievement in Biology at 0.01 level. There exists no significant relationship between Science Interest, Socio-Economic Status and Achievement in Biology.

ii) Population value of coefficient of correlation falls between -0.18 and 0.95.

iii) The shared variance between variables were ranging from 0.004 and 9.734.

iv) The predictive efficiency of ‘r’ were ranging from 0.0001 to 0.05.

For Private School Pupils

i) There exists significant positive relationship between Science Aptitude, Attitude towards Science, Science Interest, Intelligence and Achievement in Biology at 0.01 level. There exists no
significant relationship between Socio-Economic Status and Achievement in Biology.

ii) The population value of coefficient of correlation falls between 0.01 and 0.91.

iii) The shared variance between variables were falls between 0.38 and 19.4.

iv) The predictive efficiency of ‘r’ were ranging from 0.002 to 0.04.

For Government School Pupils

i) There exists significant positive relationship between Science Aptitude, Attitude towards Science, Science Interest, Intelligence and Achievement in Biology at 0.01 level. There exists no significant relationship between Socio-Economic Status and Achievement in Biology at 0.01 level.

There is no significant relationship between Socio-Economic Status and Achievement in Biology

ii) The population value of coefficient of correlation falls between 0.02 and 0.97.

iii) The shared variance between variables were falls between 0.40 and 10.95.

iv) The predictive efficiency of ‘r’ were ranging from 0.002 to 0.06.
SECTION THREE

FINDINGS RELATED TO MULTIPLE REGRESSION ANALYSIS

The result of the Multiple Regression Analysis showed that the Science Aptitude, Science Interest and Intelligence are the best subset for predicting the Achievement in Biology of secondary school pupils.

The relationship obtained (R) between some select correlates (Science Aptitude, Science Interest and Intelligence) and Achievement in Biology of secondary school pupils was 0.3417.

SUMMARY OF RESULTS

The present study revealed the following:

(i) High-, Average-, and Low-, groups of almost all select correlates viz., Science Aptitude, Attitude Towards Science, Science Interest and Intelligence except Socio-Economic Status have been significantly influencing the Achievement in Biology of secondary school pupils of Total and relevant subsamples namely Sex, Locale and Type of Management.

(ii) The correlation analysis revealed that significant positive relationship exists between almost all select correlates (Science Aptitude, Attitude Towards Science, Science Interest and Intelligence) except Socio-Economic Status and the Achievement
in Biology of secondary school pupils.

(iii) The Multiple Regression Analysis proved that the independent variables viz., Science Aptitude, Science Interest and Intelligence are the best predictors for predicting the Achievement in Biology of secondary school pupils.

CONCLUSION

In the present study, the investigator attempted to find out the significant effect of some select correlates on the Academic Achievement in Biology among secondary school pupils. Another important objective was to identify the most significant correlates for predicting Achievement in Biology among secondary school pupils. These objectives were tested through different statistical techniques like One-Way Analysis of Variance, Coefficient of Correlation and Step-Wise Regression Analysis.

From the analyses, it was found that almost all select correlates except Socio-Economic Status have significant effect and significant correlation with the Achievement in Biology, indicating that almost all of the variables are seen as predictors of Academic Achievement in Biology. But Step-Wise Regression Analysis shows only three out of five variables as significant predictors of Achievement in Biology. These three significant predictors are Science Aptitude, Science Interest and Intelligence respectively.
TENABILITY OF THE HYPOTHESES

1. The first hypothesis stated that "each select correlates has significant effect on Achievement in Biology".

   One-Way Analysis of Variance revealed that all four select correlates viz., Science Aptitude, Attitude Towards Science, Science Interest and Intelligence have significant effect on Achievement in Biology. But no significant effect exists in Achievement in Biology by the effect of Socio-Economic Status of the pupils. Hence, the first hypothesis is not fully substantiated.

2. The second hypothesis states that "there will be significant difference in the relationship of each select correlates with Achievement in Biology".

   The Coefficient of Correlations (Pearson's r) obtained between Achievement in Biology and each of the select correlates revealed that almost all the select correlates viz., Science Aptitude, Attitude Towards Science, Science Interest and Intelligence have significant positive relation with Achievement in Biology. But there exists no significant relationship between SES and Achievement in Biology. Hence, the second hypothesis for the present study is not fully substantiated.

3. The third hypothesis states that "there will be most significant correlates for predicting Achievement in Biology among secondary school pupils".

   The regression analysis showed that three out of five independent
variables are significant predictors of Achievement in Biology. Thus, the third hypothesis is fully substantiated.

**EDUCATIONAL IMPLICATIONS OF THE STUDY**

The present study has helped to locate those variables from among the select variables which have significant effect on Achievement in Biology. The variables which have most significant effect on Achievement in Biology are: (i) Science Aptitude, (ii) Science Interest and (iii) Intelligence.

On the basis of the above findings, the investigator put forward the following suggestions with regard to each significant predictor of Achievement in Biology for the improvement of the present educational practices in relation to Achievement in Biology. The following are some of the guidelines suggested:

1) Among the three identified predictors of Achievement in Biology, Science Aptitude was the most significant predictor. Therefore, development of Science Aptitude becomes the most essential for high Achievement in Biology. Science Aptitude designates certain mental abilities which denote the potentialities for future accomplishment in learning Science with regard to past training and achievement.

Some suggestions for fostering Science Aptitude are as follows:

(i) Since Science Aptitude is an inborn ability, some special programmes may be arranged in schools to boost this talent
among students. The programmes like organizing Science clubs, Science exhibition, work experience classes etc in schools will no doubt ensure the nourishment of Science Aptitude among school children.

(ii) Classroom environment may be made more comfortable and gratifying for the pupils to express their ideas and also provide ample opportunities and facilities to conduct experiments in the Science laboratory of the school.

(iii) The teachers may adopt innovative teaching methods such as the new model of teaching in the Science classes like ‘Inquiry Training Model’ to create enthusiasm towards Science among pupils.

(iv) The teachers may appreciate the pupils for their small inventions at the right time and may promote conducting science and explorative activities.

(v) Abundant opportunities for group work, group discussions and group study may be provided without any Sex bias.

(vi) Moreover, organizing science oriented vacation classes will create enthusiasm among pupils to know more and more about Science- Cochin University has conducted such programmes called “Science in Society” which may not only foster Science Aptitude among school children but also made science public.
Science Interest is the second significant predictor variable of Achievement in Biology. We know that for any achievement, interest is an essential factor. Without interest there is no successful completion of any task. Therefore, inorder to develop interest in learning especially in science subjects, certain suggestions are given below:

(i) As a Biology teacher, the investigator feels that majority of pupils likes the subject may be because of its relation to daily life. So teaching of Biology related to daily life situations will create more interest in learning the subject and make it more life-oriented.

(ii) Creating Interest in Learning Science should be made from the primary classes itself. For this, parents and teachers have equal role by developing reading habits among children especially books like science fictions, science stories, autobiographies of great scientists etc.

(iii) Application of problematic situations in Science classes will stimulate students’ interest in problem solving. Therefore teachers may provide freedom to the students to think and express their ideas freely. Make flexible every problem solving opportunity. And also, discussions should be made open and untimely judgments and evaluation may be avoided.

(iv) The teachers may find time for giving problem solving experiences and find a reward system for motivating students.
(v) The teachers may employ modern technologies like computer, LCDs, Televisions etc for teaching Science which will create interest in learning Science among school pupils.

The third significant predictor variable of Achievement in Biology is Intelligence. Teachers can provide proper environment in the classroom to improve the intelligence of the pupils. Some suggestions are as follows:

(i) The teacher can use Intelligence Test in the classroom to identify High Intelligent, Average Intelligent and Low Intelligent pupils. This will help him/her to plan the lessons according to the needs and ability of the pupils.

(ii) The skill of problem solving method is to be acquired by children through earnest participation in learning activities. Therefore students may be provided with task requiring different mental processes and operations involving inductive and deductive reasoning abilities supplemented by illustrative examples.

(iii) Depending on the scope and nature of the content, teacher may adopt information processing models of teaching on major instructional strategies for developing cognitive abilities.

(iv) Suitable refresher courses should be given to teachers which will enable them to teach science according to the intelligence of their pupil.
In short, the relation of cognitive and affective variables with Achievement in Biology shows that the usual educational practices should be based on cognitive and affective outcomes. That is, teachers should be aware of the relationship of these variables with achievement while designing instructional experiences and evaluation techniques.

SUGGESTIONS FOR FURTHER RESEARCH

1. At present there is no comprehensive test for measuring the significant predictors and predicting Achievement in Biology of secondary school pupils. So it will be better to conduct a study for the development of a comprehensive test and thereby studying its effectiveness in predicting Achievement in Biology.

2. Replication of the study with additional Independent Variables including cognitive, and Affective Variables which predict Achievement of Physics and Chemistry among secondary school pupils.

3. The same study can be extended to central schools and secondary schools affiliated to C.B.S.E.

4. Another study may be conducted to analyse Biology textbooks at secondary school level for determining the scope of the development of the significant predictors found in the study.