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CHAPTER VI

SUMMARY AND CONCLUSIONS

Modern societies are characterised by scientific and technological revolutions. The Science Policy Resolution of the Government of India illuminates clearly and concisely the relationship of science to national goals and development. The key to national prosperity, apart from the spirit of people, lies in modern age, in the effective combination of science and technology with manpower and material resource. Therefore, promotion of science education is an important factor in the progress, welfare and security of the nation. The Education Commission (1964-66) was of the opinion that science education must become an integral part of school education. A scientific outlook must be developed among the students so that it becomes part of their way of life and culture. The Commission felt that the quality of science teaching at all levels in the country has to be raised considerably so as to achieve its proper objectives and purposes such as, to promote an ever deepening understanding of basic principles; to develop problem solving and analytical skills and the ability to apply the skills to the problems of the material environment and social living; to promote the spirit of enquiry and experimentation.
Science education in Mizoram when compared to that of other states of India, suffers from serious drawbacks. Though the State is having very high literacy rate (59.88%) the quality of science education is very poor. As such, at the tertiary level most of the students opt for arts subject and those who join usually wind up the science course at the pre-university level. There may be may reasons for this, and these may be of varied nature. It may be due to lack of encouragement on the part of the parents, or lack of positive attitude, interest and motivation in science subjects. There is a feeling that method of teaching science employed in the secondary schools stage is not appropriate for an effective learning and the secondary science curriculum is not directly related with that of the pre-university stage. Needless to mention that in an economically backward and hilly tribal region, there is a paucity of competent science teachers at the school and college levels. Lack of facilities, such as science laboratory, equipment, teaching aids and reading materials are also the factors for the deterioration of standards in science. The matriculation results of the Mizoram Board of Secondary Education also indicates that there is a large incidence of failure in the science subjects in the state. Another interesting
observation is that very few girls go for higher studies in science subjects in Mizoram. Therefore it is imperative to study the sex differences in attitude towards science and achievement in science. Socio-economic environment as a factor affecting science achievement and attitude has not been examined in the researches conducted in Mizoram although there are a few studies analysing the organizational factors related to achievement in science (Lalduhsanga 1983, Zochhingpuii, 1983, Thanhawla 1983). The present study assumes significance as it examines the attitudes towards science, science achievement and problem solving ability among the secondary school students in Aizawl. The investigation is further directed to analyse sex, socio-economic status (parental education, parental occupation and family facility) and type of school as factors related to student achievement in science, attitude towards science, and problem solving ability and is entitled: A STUDY OF SCIENCE ACHIEVEMENT, ATTITUDE TOWARD SCIENCE AND PROBLEM SOLVING ABILITY AMONG THE SECONDARY SCHOOL STUDENTS IN AIZAWL.

Objectives of the Study:

The major objectives of the study were the following:
1. To study the science achievement, attitude toward science and problem solving ability of the secondary school students in Aizawl.

2. To find the interrelationships of science achievement, attitude towards science vis-a-vis the problem solving ability.

3. To examine the relative effect of sex, socio-economic status, parental education, parental occupation, family facility, and type of school on science achievement, science attitude and problem solving ability.

**Hypotheses:**

The following hypotheses were tested in the study:

1. Significant sex differences exist in the science achievement of the students.

2. Significant sex differences exist in the science attitudes of the students.

3. Significant sex differences exist in the problem solving ability of the students.

4. Significant differences exist in the science achievement of students from different socio-economic groups.

5. Significant differences exist in the science attitudes of students from different socio-economic groups.
6. Significant differences exist in the problem solving ability of students from different socio-economic groups.

7. Significant differences exist in the science achievement of students studying in Government and Deficit Schools.

8. Significant differences exist in the science attitudes of students studying in Government and Deficit Schools.

9. Significant differences exist in the problem solving ability of students studying in Government and Deficit Schools.

10. Positive and significant correlation exist between science achievement and science attitude of male secondary school students.

11. Positive and significant correlation exist between science achievement and problem solving ability of male secondary school students.

12. Positive and significant correlation exist between science attitude and problem solving ability of male secondary school students.

13. Positive and significant correlation exist between science achievement and science attitude of female secondary school students.
14. Positive and significant correlation exist between science achievement and problem solving ability of female secondary school students.

15. Positive and significant correlation exist between science attitude and problem solving ability of female secondary school students.

TERMINOLOGY

1. **Science achievement**: Science Achievement in the study has been taken as the accomplishment in science by the scores obtained by the students on an objective test in science.

2. **Science Attitude**: Science attitude has been defined as the opinion or position taken with respect to psychological object in the fields of science (Moore, 1970) and has been taken as a generalised attitude toward the universe of science content being measured in terms of favourableness or unfavourableness on items on an attitude scale.

3. **Problem Solving Ability (PSA)**: The skill of the students in understanding and analysing a problem and applying the scientific knowledge and method to solve them is designated as the problem solving ability in the present research and is being measured by a Problem Solving Ability Test (PSAT) specially developed for the study.
Sample:

The sample of the study consists of 812 students (352 boys and 460 girls) selected at random from class IX of 17 secondary schools of Aizawl. The selection of the sample was done after giving proper weightage for the type of school, locale of the school and sex of the students.

The Tools Employed:

(i) Science Achievement Test (SAT) developed in the Department of Education, Aizawl (Lalduhsanga 1983) has been used and the test included fifty multiple choice questions on science subjects Physics, Chemistry, Botany and Zoology for the secondary school classes. The test has been standardized on a sample of 300 high school students in Mizoram and norms are available. The test retest and split-half reliability coefficients were .83 and .9 respectively and test validated against the teachers rating and school terminal exam marks was quite satisfactory.

(ii) Science Attitude Scale (Grewal, 1977). A five-point 20 item Likert type attitude scale adopted to Mizoram in an earlier study was used. The split-half reliability co-efficient is .84 and norms are available for male and female; and class IX and X students separately.

(iii) Problem solving Ability Test (PSAT). The test is speci-
ically developed by the investigator for the present study. The test contains problems with respect to health and hygiene, first aid, environmental science, applied nutrition, applied physics, applied chemistry and the social evil of drugs. The initial draft of 40 item test was sent to experts for their comments and on that basis the test items were modified and some were dropped. For item analysis, the test was administered on a sample of 100 secondary school students in Aizawl and only those items which yielded statistically significant correlation coefficient (with the total scores) were retained for the final test. The final test contained 18 items on multiple choice questions carrying a weightage of one mark each for the correct response. A 'crossword puzzle' with a weightage of 12 marks and 'jumbled word puzzle' with 10 marks were the other items on the 20 items problem solving ability test. The reliability of the test worked out by the test retest method (r = .602) and the split-half method (r = .64) were quite satisfactory and the test was found to be highly valid against the teacher ratings (r = .75) and Dube's mathematical problem solving ability test scores (r = .816).

Collection of Data

The investigator personally visited the schools selec-
ted for the study and administered the tests with the help of science teachers in those schools. A set of type-written instructions were given to each testee and the tests in science achievement, science attitude and problem solving ability were administered in that sequence. The data collection was carried out during the months of October and November, 1987.

Statistical Technique of Analysis

Data collected for the study on the problem solving ability, science attitude and achievement in science were scored and tabulated. Descriptive statistics were worked out for scores on science achievement, science attitude and problem solving ability tests. Correlations coefficients were computed applying the Pearson product moment method between the test scores on problem solving ability, and that of science achievement and science attitude. Comparison of the mean scores of the sub-groups based on sex, socio-economic status, parental education, parental occupation, family facility and type of school was done by applying 't' test, and analysis of variance (ANOVA) was applied to know the interaction effects of variables sex, socio-economic status and type of school. The analysis of the data has been done with the computer assistance at International Institute of Population Sciences (IIPS), Bombay.
Findings:

1. The results revealed that the science achievement of the boys was positively correlated with the science attitude ($r=1291 \ p<.05$) and problem solving ability ($r=.3217 \ p<.01$) while their problem solving ability and attitude towards science did not show any significant relationship.

2. For female students, it was observed that the science achievement was not correlated with science attitude, while their problem solving ability was found positively correlated with science achievement ($r=.3027 \ p<.01$) and science attitude ($r=.1358 \ p<.05$).

3. Comparison of the science achievement scores of the male and female students showed statistically significant mean difference ($t=2.05 \ p<.05$) and male students were found superior in their science achievement to female students. There were no significant sex differences in the science attitude and problem solving ability of the secondary school students as the male and female students failed to differentiate in their mean scores.

4. Socio-economic status was found to be significant factor related with the science achievement, science attitude and the problem solving ability of the secondary school students.
students. Students of high SES group secured statistically significant mean scores than the low SES group on science achievement \( t=2.14 \ p \leq 0.05 \), science attitude \( t=2.01 \ p \leq 0.05 \) and problem solving ability \( t=2.006 \ p \leq 0.05 \).

5. Significant difference was observed in science achievement \( t=3.86 \ p \leq 0.01 \), science attitude \( t=2.39 \ p \leq 0.05 \) and problem solving ability \( t=4.93 \ p \leq 0.01 \) of students belonging to high and low on parental occupation. Children of officials, professionals, teachers, office assistants were found to be better than those of labourers, skilled workers and cultivators.

6. Students with high parental education were found to be better than those with low parental education in their science achievement \( t=2.36 \ p \leq 0.01 \). Parental education was also found related to the science attitude, students with high parental education group having more favourable attitude than the low group \( t=1.96 \ p \leq 0.05 \). Students with high parental education obtained higher mean score than students with low parental education and showed statistically significant difference in their mean problem-solving ability score \( t=3.45 \ p \leq 0.01 \).

7. High school students with better family facility showed statistically significant higher mean scores in their science
achievement ($t=3.47 \ p < .01$), science attitude ($t=1.99 \ p < .05$) and problem solving ability ($t=1.968 \ p < .05$) tests than those with less family facility.

8. Analysis of problem-solving ability scores of Government and Deficit school students showed statistically significant difference in favour of the Deficit School students ($t=7.79 \ p < .01$). However, the students from the two types of schools did not differ in science achievement and science attitude scores.

9. The two way interaction analysis of science achievement scores revealed that sex and socio-economic status ($F=4.818 \ p < .05$) and socio-economic status and type of school ($F=4.582 \ p < .05$) were having significant effects, whereas sex and SES failed to yield any statistically significant results. The three way interaction analysis taking sex, SES and type of schools also showed statistically significant results ($F=4.154 \ p < .05$) the male students with high SES and from Deficit schools favouring higher mean scores than female students with low SES and government schools.

10. For science attitude scores, the two way and three way interaction taking sex, SES and type of school did not reveal any statistically significant results. It was found
that SES is the only variable related to science attitude scores, students with high SES showing more favourable science attitude than those from low socio-economic backgrounds.

11. The two-way interaction analysis with respect to problem solving ability test scores revealed statistically significant result for SES and type of school (F=5.561 p < .01). The three way interaction analysis taking sex, SES and type of school failed to yield positive results. SES and type of school were found to be the factors related to problem solving ability in the present study.

Educational Implications

The present research has brought out certain salient findings which, if proper attention is given will help in the promotion of science education in Mizoram. The science achievement of the student were found positively related to their problem solving ability both among the male and the female students. However, among the female, science attitude was a positive factor in enhancing problem solving ability. Science as a subject consists of a body of facts, principles, theories and laws clubbed together with logic and reason. Specific abilities of
comprehension, recalling information, skill in experimentation, skill in solving problems, skill in handling and classifying given information, analysis, synthesis and evaluation are required for successful performance in science subjects. Problem solving ability has also the same scientific basis and this may be the reason that the science achievement and problem solving ability were positively related. This calls for proper development of problem solving skills to improve their specific abilities. The science teachers should be oriented with the skill in understanding and analysing the problems through scientific method to solve them and impart these skills among the students through their science lessons. Cultivation of proper attitude in science is also a necessary pre-requisite to improve the problem solving ability at the secondary stage especially for the girls. Sex differences in science achievement and problem solving ability have been reported in a number of studies conducted among schools and college students. (Sweeney, 1953; Terman and Tyler, 1954; McNamar 1955; Felen 1975; Maxwell 1975; Macway 1975; Singer 1975 and Hayes 1978). Analysing the reason for the poor performance of females, researchers have demonstrated the vital role played by environmental factors on sex differences in problem solving and science achievement. It has been re-
revealed that attitude towards problem solving is a main factor which bring about sex differences in ability and achievement, and society and culture play a prominent role in forming proper attitude especially among the females. The present study also recognises the importance of attitude in problem solving ability among the female students. It has also been noticed that female group is susceptible to training and practices to change their attitude towards problem solving in a positive manner and enhance their performance in scientific fields (Carry, 1955; Hoffman and Maier, 1961; Singer, 1975; Miles, 1976; Kumar, 1980). The results of these researches guide us to evolve programmes and strategies for attitudinal change especially for the female students at secondary stage. The role of parental education in promoting science attitude has been highlighted in the present study. This gives us credence to believe that the non-formal science education through package programme, contact methods and short term courses in science can inculcate interest and positive attitude towards sciences. It has been noticed that the type of school in which the children study and the facility at home are factors related to science achievement and problem-solving ability. These findings have real educational significance. Students having better
family facility are at an advantage as they are open to multimedia for acquiring scientific information. This is especially true in a remote area like Mizoram where the resources are limited. The schools in Mizoram do not have adequate facilities like science equipment, teaching aids, library, and laboratory which are significant factors for the promotion of the science education. It is observed that the Deficit schools in the state, of late, have taken special steps in conducting science exhibition, science workshops and even the production of teaching aids from local resources. This may be the reason why the students from the Deficit stream of schools showed superior ability in problem solving.

Suggestions for Further Studies.

Beyond the problem of incorporating the findings of the present research into policies and programmes for the promotion of science education in the state of Mizoram, certain other related issues seem to be significant and as such are recommended for further investigations:

1. Studies related to the development of concept formation and problem solving skills among the rural and urban secondary school students.
2. Experimental studies to investigate the effect of passive and active educational environment on problem solving ability, intellectual development and science achievement.

3. A comparative study of the personality factor patterns and problem solving ability among the gifted and backward children.

4. Problem solving behaviour in relation to personality, intelligence and age: A study of college students in Mizoram.

5. Achievement motivation, adjustment and self-concept as related to the academic achievement of secondary school students.

6. A study of the effect of socio-economic environment and school stream on the mental abilities and the academic achievement of high school students in Mizoram.

7. Effect of classroom learning situations on the attainment of objectives of science education in elementary school.