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## CHAPTER - V

### SUMMARY AND CONCLUSIONS

#### INTRODUCTION

Over the centuries, philosophers and later, the psychologists tried to study and explain human behaviour and the human mind. Educationist and psychologists, today have taken a keen interest in studying and understanding the various thinking processes underlying the working of the mind.

Science learning develops knowledge and the ability to think logically to draw conclusions and to make decisions at a higher level. Science provides the foundation as also the instrument for the nation progress, security and welfare. Science becomes a priority area in Education, the prime objective, in individualistic perspective is the cultivation of a scientific temper which includes a spirit of enquiry, a disposition to reason logically and dispassionately, a habit of judging beliefs and opinions on available evidence. Science education would give individuals a firm grasp of the concepts and processes of science and

impact to them the ability to use the scientific method of problem solving and the techniques of observation and experimentation in handling problem of comprehension or life.

The National policy on Education (1986) emphasis sciences and science education at the secondary level. It states, "science education programmes will be designed to enable the learner to acquire problem solving and decision making skills ...":

The attitudes of scientists involves critical observation, open mindedness, suspended judgments. Science develops intellectual, utilitarian, vocational, cultural, moral, aesthetic value and psychological value.

Science and Technology in this century have become the growing edges of our society which almost keep us out of tune with the times in which we live within the context of schooling. Education for concept development, problem solving and creative behaviour have become the slogans of the day which are least understood even now. The true aim of education is to discipline and train the mind rather than to furnish it with information and non-functional knowledge to the use of its own power.

As the child grows up his thinking process changes. According to Piaget, there are four definite stages, in the growth of intelligence in the child these are -

- (1) Sensory motor stage ( 0-2 years )
- (2) Pre-logical stage ( 2-7 years )
- (3) Concrete operational stage ( 7-11 years )
- (4) Formal operational stage ( 11-15 years ).

The first stage is of little educational significance. In the second stage, the thinking or reasoning is transductive and intuitive. In the third one, reality dominates thinking which is reversed in the fourth, where possibilities are proposed and examined the ultimate equilibrium of intelligence (even abstract thinking) is found in this stage.

It is at the last stage that the adolescent pupil is in a position to speculate over possibilities rather than sticking to the realities of the situation, employ combinatorial system and propositional logic of conjunction, disjunction negation and implications.

In the context of the present study, it is to be observed whether the adolescent pupils is in a position to state and test hypotheses, when several test

situations inhering this variable are presented to him. Present study aims at; to determine the relationships among scores on stating hypotheses, testing hypotheses and achievement in science, to look for varied patterns of responses leading to the formation of experimental mind.

**The Study :**

Statement of the problem.

"A study of the Growth of experimental mind and achievement in science during Adolescence ".

**Significance of the Study :**

The science curriculum in schools are revised very often, to incorporate more new and complex concepts. The child's mind should be developed to grasp and solve the complex problems he is exposed to .

This study attempts to probe whether our adolescents have developed the abstract thinking ability and reached the formal stage as propounded by Piaget.



Abstract thinking is essential for learners of science, as one is required to manipulate ideas and possibilities in mind. The development of abstract reasoning among adolescents is more urgent today, than ever before due to the complexity of the world today, they are faced with complex problems., due to the rapid advancement of science in today's world.

As far as the knowledge of the investigator goes, no work of this nature, determining the ability to do controlled experimentation by the adolescents of the Marathwada Region, has been attempted before.

Hence, this piece of research work is important as it highlights the level of mental operation of these adolescents.

#### **Limitations of the Study :**

The study was conducted on -

- (1) Adolescents of grades VII, VIII, IX and X only.
- (2) Sample was drawn from Aurangabad City only.
- (3) Sample was drawn only from Private.

Schools following the syllabus prescribed by the Maharashtra State Government.

**Objectives of the Study :**

- (1) To investigate adolescent thought through an instrument incorporating Piaget type tasks.
- (2) To find out the differences in the Mental Operations of stating of Hypotheses and testing of hypotheses among Gifted normal and below normal adolescents.
- (3) To determine the Sex differences on the ability to do controlled experimentation.
- (4) To determine the relationship between the two mental operations : stating of Hypotheses and Testing of Hypotheses.
- (5) To look for varied patterns of responses leading to the formation of experimental mind, in different age groups during adolescence.
- (6) To determine the relationship between the ability to do controlled experimentation and achievement in science.

**Hypotheses :**

To be tested.

- (1) There is no significant difference in the ability, to state hypotheses at different ages (11+ to 14+)

- (2) There is no significant difference in the ability to test hypotheses at different ages.
- (3) There is no significant difference in the ability to state hypotheses, among the gifted, normal and below normal adolescents.
- (4) There is no significant difference in the ability to test hypotheses among the gifted, normal and below normal adolescents.
- (5) There is no significant sex difference in the ability to do controlled experimentation.
- (6) There is no significant relationship between the scores on the ability to do controlled experimentation and the scores on achievement in science.

#### **Research Design of the Study :**

Survey and analytical methods of research were found to be appropriate for the present study and were used in this study.

#### **Sample :**

A random sample of 400 pupils studying in 4 private Schools was taken. The sample for the present study was comprised of both sexes of pupils, they were drawn from grade VII, VIII, IX and X



from the following schools.

- (1) Holy Cross Convent High School, Aurangabad.
- (2) Saint Francis High School, Aurangabad.
- (3) Sharda Mandir High School, Aurangabad.
- (4) S.B. High School, Aurangabad.

**Data Gathering Tools :**

Tools used in the study are,

- (1) Stating of Hypotheses questionnaire.
- (2) Testing of Hypotheses questionnaire.
- (3) Culture Fair (free) Intelligence Test  
(Scale II form A) Cattell and Cattell.
- (4) Scores on achievement of science  
(From School Record).

**Collection of Data :**

In order to choose Gifted Normal and Below Normal pupils for the study, intelligence test was conducted and on the basis of it, I.Q. of pupils was determined, <sup>and pupils classified</sup> On the following day the stating of Hypotheses Questionnaire was administered and they were asked to answer testing of Hypotheses questionnaire the next day. In this way Data was collected.

**Techniques Used for the Analysis of Data :**

Statistical measures such as Mean and Standard deviation were computed in pursuance of objectives, Appropriate 't' Test was employed in order to test hypotheses 1 to 6.

**Findings of the Study :**

The study reveals the following findings.

- (1) The ability to state hypotheses increases when there is increase in I.Q.
- (2) Formal thinking is highly dependent on I.Q.
- (3) There is relationship between achievement of science and I.Q.
- (4) There is significant difference in the ability to state hypotheses at 11+ and 12+ grades.
- (5) There is significant difference in the ability to state and to test hypotheses at 12+ and 13+ grades.
- (6) There is no significant difference in the ability to state hypotheses and to test hypotheses at 13+ and 14+ grades.
- (7) There is significant difference in the ability to state Hypotheses among the gifted normal and below normal adolescents.

- (8) There is significant difference in the ability to test Hypotheses among the gifted normal and below normal adolescents.
- (9) There is no significant sex difference in the ability to do controlled experimentation.
- (10) There is significant difference in the scores on the ability to do controlled experimentation and the scores on achievement in science.
- (11) VII grade pupils are unable to test Hypotheses.
- (12) As age increases the ability to do controlled experimentation increases.

**Eductional Implications :**

- (1) There is lot of concrete thought as well as prelogical thought present among the adolescent pupils. It is possible to educate them out through appropriate methodology where pupils are compelled to see the same situation from other points of view or in different contexts.
- (2) The school should provide more equipments and proper school environment to get pupils interested in experimentation.
- (3) It is the job of school to promote efficient thinking among its pupils, specifically speaking

it is possible to design experiences, for pupils of Gifted, normal and below normal pupils.

- (4) The curricula framers should modify the curriculum accordingly to develop the logical thinking in our adolescents for their better future prospects and for the future national growth and development.
- (5) Teacher should arrange activities like science exhibition, science fair etc., which will raise the pupils curiosity, scientific thinking etc. because pupils are interested in such activities.

#### Suggestions for further Research :

Any investigation answers only a few questions. It can not be complete in itself. And, when the growth of experimental mind is being investigated, the conclusions drawn remain purely hypothetical so the need for further studies arise. Following are some of the suggestions for further research.

- (1) This study may be taken up at Higher Secondary Levels i.e. at Grades XI & XII.
- (2) A properly planned longitudinal study may be taken up to see the growth of experimental mind during adolescence.



- (3) The same study may be extended to find out, the effect of training of scientific attitude on the Growth of experimental mind and achievement in Science.