"Test scores reflect ability they do not
determine ability. Test scores may suggest,
but never prove. We are much safer when we
make interpretations based on the actual
performance of those who have had similar
scores than when we try to tell an examinee,
'This score means that you willi........'

- Lyman -
CHAPTER VI

FINDINGS, CONCLUSIONS AND SUGGESTIONS

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6.0. INTRODUCTION:

The detailed report of the present investigation has been given in the previous chapters. In the present chapter the summary of the report has been presented with a view to giving the idea in nutshell. It is accompanied by the observations made by the investigator during the experiment and the implications of the findings.

It is generally observed that the traditional methods of teaching have failed to develop thorough understanding of concepts in students. Through traditional method, students learn concepts by associating words with labels and by cramming the definition without being aware of the essential attributes of the concept. Such rote learning makes them attain incomplete, and sometimes wrong, concepts. As a result, they fail to understand the information based on these concepts. Teachers, therefore, need to use more effective strategy of teaching concepts. Researchers need to try out the essential phases of teaching concepts in the actual classroom in order to make clear by this strategy.
Attempts have been made in this respect. In the classroom, Concept Attainment Model (CAM) has been tried out for teaching concepts in Mathematics (Chitriv, 1983) and in Science (Pani, 1985, Kumara, 1985, Sharma, 1986; Gangrade, 1986, 1987; Grewal and Kaur, 1987). The promising results have been obtained in these researches. Yet, there is a need to conduct more experimental studies in order to determine the effectiveness of CAM V/s. Traditional Method for teaching concepts in Mathematics and Science. The present study is an attempt to study the effectiveness of CAM as compared to that of Traditional Method for teaching concepts of Science. The brief summary of the research work is stated in forthcoming caption.

6.1. SUMMARY OF RESEARCH WORK:

The statement of this research work indicates the development of teaching strategy as developed by J.M. Bruner in his model known as Concept Attainment Model. It also indicates the effect of this teaching strategy (CAM) on the achievement of pupils in Science of Std. VIII.

Firstly, the researcher had enlisted the concepts in Science included in the syllabus of Science of Std. VIII. For each concept the teaching strategy was developed by the investigator keeping in mind the five elements:

1. Name  
2. Examples  
3. Attributes  
4. Attributes Value  
5. Rule
To control I.Q. - capability of the pupils as one of the variables, two equal groups were formed on the basis of I.Q. scores. After giving the treatment to experimental group the achievement test was given to all the pupils under study.

The tools used for the study were:
1. The concept development strategy according to CAM.
2. S.E.S. scale
3. General Ability Test
4. An Achievement Test in Science

The sample of the study was taken as below:

As this study is an experimental work, it indicates a sample of hundred pupils of Std. VIII of one school. The purpose of having experimentation in one school is to avoid the effect of school environment as one of the factors. There were sixty one boys and thirty nine girls in the purposive sampling coming from various socio-economic status.

The design used for the study was a factorial design (2 x 2 x 2) corresponding to the three independent variables, as mentioned below:
1. Treatment varied at two levels: CAM and Traditional
2. S.E.S. varied at two levels: High and Low
3. Sex varied at two levels: Boys and Girls
A total of 100 pupils from the Std. VIII participated in the study. Out of this 100 observations 80 observations made on achievement test in Science were subjected to the statistical technique of ANOVA (F-test) to study the overall significance of difference in the main and interactive effects on independent variable under study. Subsequently, the t-test was applied in order to examine the significance of specific sub groups.

The inferences narrated by statistical analysis which have been summarized in the coming caption after general observations made by the investigator during the teaching process to develop the concepts in Science.

6.2. GENERAL OBSERVATIONS:

In the process of teaching concepts in Science according to CAM, the teacher plays an important role as the open class room climate induces the students to think and to learn freely. The teacher is the same throughout the teaching period of nine weeks as there was only one experimental group under study. Moreover, the necessary instructions to maintain proper class room climate were imparted to students. Some of them are listed as below:

1. Make students more alert to the concepts in Science as a stimuli in the mind of a teacher.
2. Be more sensitive for building new hypothesis and encourage the pupils to build the hypothesis.
3. Develop tolerance of the responses to regarding positive and negative examples and essential and non-essential attributes of an object for idea.

4. Encourage the students to exhibit their ideas in (a) Yes or (b) No form

5. Ask to compare the attribute of an object (concept) on the basis of stimulus and responses obtained during the teaching-learning process.

6. Emphasize on the derivation of a rule - a general statement about the concept.

7. Help the students to think and to testify the hypotheses built by them and develop a free and relaxed classroom atmosphere.

Such a healthy and free atmosphere encouraged the students to think in various dimensions at close quarters. The following observations were made during experiment:

1. The students of the Experimental Group were eager to know about the purpose of CAM.

2. They showed greater interest in learning concepts through CAM and gave whole-hearted cooperation in the experiment.

3. They were found motivated to learn better for their attainment of the concept during the teaching.
4. The brighter students were able to formulate more hypotheses about the attributes or concepts than average and below average students.

5. In the beginning some of the students hypothesised without any reasoning or copied down hypotheses from others.

6. After explaining the purpose and benefit of forming self-study habit and developing independent thinking skill, they tried to learn on their own.

7. At times, they got confused and were led by guessing, yet their effort was appreciable.

8. Though CAM encouraged independent thinking, active student involvement and interaction among them, sometime many clever pupils monopolised the interaction.

9. Most of the students found it difficult to identify the essential attributes of the concept and state the rule in terms of the essential attributes in their own words.

10. In the beginning, most of the students used the partist strategy for attaining the concept, but gradually they began to use the wholist strategy.

11. The students' opined that they would be benefited by CAM more in learning concepts in this way.

12. They had to face the language of a concept which is constructed on the basis of Sanskrit.
13. The students of both the groups took the tests given to them with utmost interest and enthusiasm.

The investigator received whole-hearted co-operation from the Principal, the Teachers and the Students of the school during experimentation.

6.3. STATISTICAL OBSERVATIONS AND CONCLUSIONS:

The present study deals with the effectiveness of teaching concepts in Science on the basis of different five phases of Concept Attainment Model.

On the basis of data obtained the statistical observations and conclusions are discussed according to the hypotheses formulated. They are briefly given below:

Study - 1: Treatment - A (CAM) V/s Achievement:

The first hypothesis for the study was the direct one for the study was made with an experimentation, i.e. teaching the concept through CAM.

The data for $H_{D1}$ are cited below:

Data: Table 5.6 shows that

$F_{obs} (30.09) > F_{tab} (6.98)$ at 0.01 level

Table 5.7 shows that experimental group (54.95) Control group (44.97)
Hence the observations and conclusions are made as under:

Observation: The hypothesis $H_{D1}$ is accepted.

Conclusions:
1. There was a significant effect of teaching strategy for concepts in science on the achievement of the pupils.
2. The mean difference in achievement scores was in favour of experimental group.
3. The relation between two groups is shown below symbolically:
   
   \[
   \begin{array}{c|c|c}
   \text{Exp. Group (CAM)} & \text{Control Group (Traditional TT)} \\
   \text{Study - 2: S.E.S.- B V/s Achievement} & \\
   \end{array}
   \]
   
   S.E.S. was the second independent variable which was dichotomized at two levels viz. high and low. As no one can say the effectiveness of S.E.S. on the academic performance positively, the investigator formulated the hypothesis in the null form.

Data for hypothesis $H_{02}$ are cited below:

Data: Table 5.6 shows that $F_{\text{obs}}(4.65) > F_{\text{tab}}(3.97)$ at 0.05 level.

and Table 5.7 shows that mean of high S.E.S. (52.8) > Low S.E.S. (47.1)

Observation: The hypothesis $H_{02}$ is rejected.
Conclusions:
1. This alternative hypothesis was accepted.
2. There was a significant difference on achievement in Science of the pupils of high S.E.S. group and low S.E.S. group.
3. The pupils coming from high socio-economic status shown better academic performance.
4. The relation between the two groups is shown below:
   (High S.E.S. Gr.) > (Low S.E.S. Gr.)

Study - 3: Sex V/s Achievement

Sex was the third independent variable. To study the effect of sex on Achievement the null hypothesis \( H_0^3 \) was formulated.

Data for hypothesis \( H_0^3 \) are cited below:

Data: Table 5.6 shows that

\[
F_{\text{Obs}} (11.48) > F_{\text{tab}} (6.98) \text{ at } 0.01 \text{ level}
\]

and Table 5.2 shows that

Boys Mean (47.67) < Girls Mean (50.55)

Observation: The hypothesis \( H_0^3 \) is rejected.

Conclusions:
1. This Alternative hypothesis was accepted.
2. There was a significance sex difference on achievement of pupils in Science.
3. Girls shown better performance in the achievement of Science than that of boys.
4. Symbolically, \( G > B \).
Study - 4: Treatment and S.E.S. (AB) V/s Achievement

To study interactive effect of A & B the null form hypothesis $H_{04}$ was formulated.

Data for the hypothesis $H_{04}$ are listed below:

**Data:**

Table 5.6 shows that $F_{obs} (0.44) < F_{tab} (3.97)$ at 0.05 level.

Table 5.2 shows that the mean score of

- (H.S.E.S. + Exp.) is 57.15
- (H.S.E.S. + Control) is 48.5
- (L.S.E.S. + Exp.) is 52.75
- (L.S.E.S. + Control) is 41.45

**Observation:** The hypothesis $H_{04}$ is accepted.

**Conclusions:**

There was no interactive effect of Treatment and S.E.S. on the achievement in Science i.e. there was no combined effect of Treatment and S.E.S. levels on the academic Achievement in Science, even though the main effect of both the independent variables were found significant.

Study - 5: Treatment and Sex (AC) V/s Achievement

To study interactive effect of A and C the null form hypothesis $H_{05}$ was formulated.

Data for $H_{05}$ are cited below:
Data: Table 5.6 shows that
\[ F_{\text{obs}} (0.44) \ll F_{\text{tab}} (6.98) \text{ at } 0.01 \text{ level.} \]

Table 5.2 shows that the mean score of Boys
Expt. is 53.75 (A1 C1)
Girls Expt. is 56.15 (A1 C2)
Boys control is 46.95 (A2 B1)
Girls control is 42.00 (A2 B2)

Observation: The hypothesis \( H_0 \) is accepted.

Conclusions:
(1) There was no interactive effect of Treatment and Sex on the achievement in Science.
(2) \( (A_1 C_2) > (A_1 C_1) > (A_2 B_1) > (A_2 B_2) \)

Study 6: S.E.S. and Sex (BC) V/s Achievement

To study the interactive effect of S.E.S. and Sex on Achievement in Science, the null hypothesis \( H_0 \) was formulated.

Data for it is cited below:

Data: Table 5.6 shows that
\[ F_{\text{obs}} (2.50) \ll F_{\text{tab}} (6.98) \text{ at } 0.01 \text{ level.} \]

Table 5.2 shows that the mean score of
H.S.E.S. - Boys is 53.8
L.S.E.S. - Boys is 45.35
H.S.E.S. - Girls is 51.85
L.S.E.S. - Girls is 48.85
Observation: The null hypothesis $H_0$ is accepted.

Conclusions:
(1) There was no significant interactive effect of S.E.S. and Sex on the achievement in Science.
(2) $(B_1C_1) > (B_1C_2) > (B_2C_2) > (B_2C_1)$

**Study 7**: Treatment x S.E.S. x Sex (ABC) V/s Achievement

To study the combined effect of all the three independent variables, the null hypothesis $H_{07}$ was formulated. The data for it is cited below:

**Data**: Table 5.6 shows that

$F_{obs} (0.44) < F_{tab} (3.97)$ at 0.05 level.

Observation: The null hypothesis $H_{07}$ is accepted.

Conclusions:
There was no significant interactive effect of all the three independent variables on the achievement of the students in Science.

**Study 8**: Mean differences among the 8 groups.

To study the difference among 8 groups the t-test Duncan's Multiple Range Test

**Data**: 
- $t (A_1B_2C_2 - A_2B_2C_1) = 17.1 > 13.04$ at 0.05 level
- $t (A_1B_2C_1 - A_2B_2C_1) = 17.1 > 13.04$ at 0.05 level
- $t (A_1B_1C_1 - A_2B_2C_1) = 19.1 > 17.19$ at 0.01 level
- $t (A_1B_1C_1 - A_2B_2C_1) = 21.6 > 17.19$ at 0.01 level
The rest 24 t-value were not found to be significant.

Observations:
(1) Only 4 group-differences were found to be significant and rest 24 groups differences were not significant.
(2) The common lowest mean group is $A_2B_2C_1$.

Conclusions:
(1) $(A_1B_1C_2, A_1B_1C_1) > A_2B_2C_1$
$A_1B_1C_2$ and $A_1B_1C_1$ groups pupils had shown better performance in Science than $A_2B_2C_1$ group pupils.
(2) $(A_1B_2C_2, A_1B_2C_1) > A_2B_2C_1$
$A_1B_2C_2$ and $A_1B_2C_1$ groups pupils show good performance in Science than $A_2B_2C_1$ group pupils.

In brief, out of all the 24 t-tested groups, the superior group is $A_1B_1C_2$ i.e., treatment - High SES - Girls group and the inferior group $A_2B_2C_1$ i.e., No treatment - Low SES - Boys group.

On the basis of the observations and conclusions derived by the inferential statistics, the findings made in this study were discussed in length in the next coming para.
6.4. FINDINGS AND DISCUSSIONS:

From the above observations and conclusions, the investigator has made the bird-eye-view. The findings of this study are as under:

(1) The treatment through teaching strategy according to Concept Attainment Model shows positive effect on the achievement of the pupils.

(2) The socio-economical environment plays a great role in enhancing the achievement in Science.

(3) Girls have achieved better in Science than boys.

(4) No interactive effect is found. So the main effect of three variables of the study are considered to be independent.

The findings of this study are taken for discussion below:

Finding - 1:

The Concept Attainment Model was found more effective in raising the achievement of the pupils than that of the Traditional Teaching. This finding is supported by Chitrive (1983), Kumara (1985), Das (1988) and Gangrade (1987).

It is a fact that the work of J. Bruner and his colleagues culminated many years of research into the process by which pupils acquire concepts. As a result, they
developed systematically and scientifically the model of teaching known as CAM. There are three variations viz., Reception, Selection and Unorganized material. Out of which only Reception Model of CAM was concentrated for the study. This is the primary stage of CAM. The investigator had worked with this Reception Model to develop the concepts of Science in the Indian cultured heritage. So it can be considered as an effective way of teaching Science concepts. The due care for conceptual activities would be taken by the investigator.

Finding - 2:

The socio-economic status plays a significant role in attaining the concept in science.

The pupils are coming from various S.E.S. levels to school. The basic assumption is that the environment is so diverse and humans are found unable to discriminate so many objects and aspects of the objects, from this kind of environment. The diversity found in the environment indicates the opportunity does not reach to the persons of various strata to the society. Hence the students coming from high S.E.S. could discriminate the objects encountering their attributes and attribute values, while the pupils coming from low S.E.S. could not. The S.E.S. plays a role in attaining the concept through CAM is duly accepted.
Finding - 3:

Girls showed better performance in science than boys, even the concept of science had been taught according to CAM. All over the world, it is heard that girls pay more attention to their studies than boys. Girls seemed more careful about their studies than boys. Through this daily house-hold work, they come across many different objects, so they can recognize and to select as per wide usability at home. This environment helps girls more in understanding science - Home Science.

Finding - 4:

The main effect of all the three independent variables - treatment, S.E.S. and Sex are found significant on the achievement in Science. But their interactive effects are not found significant, so for enhancing the achievement in Science of the pupils, the special treatment of teaching viz., CAM and the facilities to low S.E.S. pupils should be provided. Moreover, the opportunities to have various experiences should also be provided through excursion, buying the house-hold things - objects, reading various books of general knowledge, so that the pupils can classify and categorize the objects to be observed by them.

So this study made by the investigator is provided worth for its educational implications.
6.5. EDUCATIONAL IMPLICATIONS:

The present class room teaching appears to be very low motivated, as the teacher, directed as well as dominated, provides less opportunities to pupils for their involvement and initiatives. This results negatively on pupils' interest and highly convergent in nature. The main objective of this research, therefore, was to develop the teaching strategy of the concepts according to Concept Attainment Model and to teach the concept in science as per the strategy decided by the investigator. This type of teaching the concept (कक्षा में अध्यापन) would provide a new direction to the traditional way of teaching.

Under the present critical situation, when the National Policy of Education in India (1986) put emphasis on the self-learning, self-evaluation, child centered education and thinking process, this type of teaching through a Concept Attainment Model strategies would be helpful to motivate the pupils to learn fundamental concepts in science, to create open class-room climate and to fulfil the objectives laid down in the National Policy of Education.

Helping children to learn concepts efficiently is a fundamental purpose of schooling. The concept attainment Model provides the opportunity to learn the concepts.
Concept Attainment Model may be used with all ages and grade levels.
- The teachers can use this model very successfully with the kindergarten children, who love the challenge of the inductive activity.
- The teacher can use this model to explain the abstract concept on giving the concrete examples — Ideas to the elementary school students.
- In this secondary grades, the teacher can take the essence of the model and incorporate its features into their natural teaching style and form.
- The Concept Attainment Model is an excellent evaluation tool if teachers want to determine whether important ideas introduced earlier have been mastered. It quickly reveals the depth of students' understanding and reinforces the previous knowledge.
- The model can be useful in opening up a new conceptual area by initiating a sequence of individual or group inquiries. So the investigator has decided to suggest for the further researches in the field of teaching the concepts according to CAM.
6.6. SUGGESTIONS FOR FURTHER RESEARCH:

This research has produced the positive and encouraging results and hence the findings of the present study have a few implications for the researchers who want to work in this area. The studies can be designed in any aspect as mentioned below:

1. The same study should be replicated on larger sample.
2. The same study can be undertaken in other school subjects.
3. The same study can be replicated on the various levels of secondary schools.
4. The same study can be done on the primary and pre-primary school children.
5. Concept Attainment Model can be compared with other models of teaching concept e.g., Inquiry Model, J.I. Model.
6. The effectiveness of other two selection models and unorganized material can be studied for attaining the concept in future.
7. The effect of CAM might be found with reference to other psycho-social variables.
8. The post effect of such teaching strategy might be found as a follow up work.
It is so essential in the field of education to give new approaches of Training and Learning process. Indian Education Policy has put emphasis on the child-centered education, so that the learners get an opportunity to think. This type of Teaching Model provides and encourages to think in the classroom. Therefore it is a pious duty of all to study and apply such techniques of teaching in various branches of education.

So, the investigator recalls the swords of Swami Vivekanand:

"Arise, Awake, and Stop not
Till the goal is reached."

This can give inspiration to all those who may undertake the research in future.

References

