CHAPTER VII
SUMMARY AND CONCLUSIONS

7.0 Introduction
7.1 Summary of the research work
7.2 Classroom Observations
7.3 Statistical Observations
7.4 Findings and Discussion
7.5 Educational Implications
7.6 Direction for Future research

Bibliography
Chapter - VII

SUMMARY AND CONCLUSION

7.0 Introduction:

The creative teaching model, through the appropriate use of teacher strategies produced both thinking and feeling behaviours. Thus it has contributed to the cognitive and affective development of the students.

Under ordinary conditions the students have become conditioned to one right answer to every situation. If he cannot find that right answer he becomes perplexed, and even gets discouraged. The student will make a move only when he is sure of getting the right answer. This situation must be changed.

CTM encourages flexible thinking, originality, risk taking, curiosity and imagination. Through this method teacher can include more instruction. This is possible because under this approach pupils will become more productive, creative and self-reliant.

The cognitive - affective model of Williams and the ideas developed by him were field tested in US and were
found to be effective. This provided the theoretical support for CTM.

This chapter contains the summary, findings and suggestions for future research.

7.1 Summary of the research work:

This study consists of two parts: (i) development of Creative Teaching Model and (ii) investigation of its effect on the achievement and attitudes of students. The content chosen was some topics from IX class mathematics of Andhra Pradesh.

The Creative Teaching Model was developed by the investigator on the basis of the Williams' three dimensional model for implementing cognitive - affective behaviours in the classroom.

Dimension 1 is mathematics. It contained topics from four major branches of mathematics namely (1) Algebra, (2) Coordinate Geometry, (3) Geometry, (4) Statistics. The topics used were sets, ordered pairs, functions, relations, matrices, inequations, permutations, Binomial theorem, logarithms, linear graph, simultaneous equations, concurrency and measures of dispersion.

Dimension 2 consisted of teacher behaviour. This was a series of strategies or modes of teaching. Williams
had developed a set of 18 strategies, out of which the following 9 were chosen as they were found to be appropriate for the content. They were:

1. Organised Random Search
2. Skills of search
3. Examples of change
4. Visualisation Skill
5. Analogies
6. Provocative questions
7. Evaluate situations
8. Discrepancies
9. Attributes.

Dimension 3 consisted of eight pupils behaviours of which four were cognitive and four were affective. They were: Fluent thinking, Flexible thinking, Original thinking, Elaborative thinking, Curiosity, Risk taking, Complexity and Imagination.

A set of thirty ideas were developed by the investigator using the three dimensions described above. They were subjected to a preliminary tryout and in the light of experience suitable modifications were made. The final form (Appendix 1) was used in the experiment. The treatment was given to the experimental group lasted from July through March of the academic year.

The following tools were used for measuring the four independent variables and the two dependent variables: (i) Achievement - scores from school records, (ii) Attitudes - Attitude test developed by H.G. Desai, (iii) Motivation - JIM scale developed by the extension unit of M.B. Patel College of
Education, (iv) Parental Education - a bio-data sheet developed by the investigator.

The design chosen was a $2^4$ Factorial Design. Each of the independent variables was at two levels.

Experimental - Control
Boys - Girls
High motivation - Low motivation
High Parental Education - Low Parental Education

A total of 112 students were selected from IX class of Shri M.G.H. School, Guntur for the experiment. They were divided into two groups one experimental and another control. Each group consisted of equal number of Boys and Girls. The CTM was used for the experimental group. The control group had normal instruction. The execution of the programme was explained in detail in chapter V.

The data collected was subjected to Analysis of Variance (ANOVA). The $F$ test was used to test the significance of the effects of various factors. The data and the procedure of analysis were explained in chapter VI.

The observations and analysis were summarised in the following two sections: 7.2 and 7.3.
7.2 Classroom Observations:

During the implementation of the programme students not only displayed flexibility but also some originality. For example, while the investigator taught idea No. 1, a student gave the name 'Kinnera' for a great river. It is just a big canal. He thought it great because it was described by a great poet in a poem. Thus the need for a precise rule for determining the elements of a set was made evident.

While studying idea No. 3 students faced the complex situation of comparing lines of unequal lengths, they became confused. In their minds they referred to their lengths while they have to regard them as two infinite sets. Similarly for a while they held to the traditional notion of big and small when comparing the sets N and E.

In idea No. 8 the concept of slope of a line was taken. One student's line did not intersect the Y-axis. It was parallel to Y-axis. He faced the impossible situation of dividing by zero. Then the investigator explained that it was a special case. The vertical line has no slope. Thus discrepancies could be used for embellishing an idea.

While writing the equations in matrix form (idea No. 12) they gave some unusual forms like

\[
\begin{pmatrix}
5 & 2 & 7 \\
3 & 1 & 7 \\
3 & 1 & 4
\end{pmatrix}
\]
The students themselves gave reasons and discarded those forms. The first one was clumsy. The second one fails to indicate the equations. The third one is against the idea of equal matrices.

The matrix multiplication was dealt with in idea No. 14. One student asked 'Why cannot we just multiply the corresponding elements of two matrices?' The investigator gave the reply 'it fails in the case of market problem,' and demonstrated it. Though the investigator knew the importance of inner products in higher mathematics he could not give a satisfactory positive reply to the student.

Such episodes are too many to be listed. On the whole the programme was well received by the students and worked satisfactorily. The four cognitive and four affective behaviours were displayed by the pupils when the appropriate modes of teaching were used.

7.3 Statistical Observations:

On the basis of data analysis done in chapter VI the following observations and conclusions were made. They are briefly described below.
Study 1: Treatment Vs Achievement.
$H_1$: There is a significant difference between the achievements of control group and experimental group.

The null form of the hypothesis was tested.

Data:

\[
F_{\text{obs.}} = 25.18 \quad F_{\text{tab.}} = 6.92^{++}
\]

\[
M_{A_1} = 47.03 \quad M_{A_2} = 38.61
\]

Observation:

The null hypothesis was rejected.

Conclusion:

1. The substantive hypothesis was accepted.
2. The means show that the achievement of experimental group was better than the control group.
3. The CTM had improved the achievement of students.

Study 2: Sex Vs Achievements

$H_2$: There is no significant difference between the achievement of boys and girls.

Data:

\[
F_{\text{obs.}} = 8.61 \quad F_{\text{tab.}} = 6.92^{++}
\]

\[
M_{B_1} = 45.27 \quad M_{B_2} = 40.37
\]

Observation:

The null hypothesis was rejected.

Conclusion:

1. The difference is significant
2. $M_{B_1} > M_{B_2}$
3. The achievement of boys is better than the achievement of girls.
Study 3: Motivation Vs Achievement

H₃ : There is no significance difference between the achievements of low motivation group and high motivation group.

Data: \( F_{\text{obs.}} = 23.09 \) \( F_{\text{tab}} = 6.92^{++} \)

\( M_{c1} = 48.86 \quad M_{c2} = 39.41 \)

Observation:
The null hypothesis was rejected.

Conclusion:
1. The difference is significant.
2. \( M_{c1} > M_{c2} \)
3. The achievement of high motivation group is better than the achievement of low motivation group.

Study 4: Parental Education Vs Achievement

H₄ : There is no significant difference between the achievements of Low Parental Education Group and High Parental Education Group.

Data: \( F_{\text{obs.}} = 58.59 \) \( F_{\text{tab}} = 6.92^{++} \)

\( M_{d1} = 49.25 \quad M_{d2} = 36.40 \)

Observation:
The null hypothesis was rejected.
Conclusion:

1. The difference is significant.

2. $M_{D1} > M_{D2}$

3. The achievement of High Parental Education Group is better than the achievement of low Parental Education Group.

Study 5: CTM $\times$ Sex Vs Achievement

$H_5$: There is no significant effect of the interaction of CTM and Sex on the achievement of students.

Data: $F_{obs.} = 0.26$  $F_{tab.} = 6.92^{++}$

Observation:
The null hypothesis is not rejected.

Conclusion:
There is no significant interaction effect of Sex and CTM on achievement.

Study 6: CTM $\times$ Motivation Vs Achievement:

$H_6$: There is no significant effect of the interaction of CTM and motivation on the achievement of students.

Data: $F_{obs.} = 1.04$  $F_{tab.} = 3.95^{+}$

Observation:
The null hypothesis is not rejected.
Conclusion:

There is no significant interaction effect of CTM and motivation on achievement.

Study 7: CTM x Parental Education Vs Achievement

H₇ : There is no significant effect of interaction of CTM and Parental Education on the achievement of students.

Data: \[ F_{\text{obs.}} = 0.26 \quad F_{\text{tab.}} = 3.95^+ \]

Observation:
The null hypothesis is not rejected.

Conclusion:
The interaction effect of CTM and Parental Education on achievement is not significant.

Study 8: Sex x Motivation Vs Achievement:

H₈ : There is no significant effect of the interaction of sex and motivation on the achievement of students.

Data: \[ F_{\text{obs.}} = 5.4 \quad F_{\text{tab.}} = 3.95^+ \]

Observation:
The null hypothesis was rejected.

Conclusion:
The interaction effect of sex and motivation on achievement is significant.
Study 9: Sex x Parental Education Vs Achievement.

H₉: There is no significant effect of the interaction of sexa and Parental Education on achievement.

Data: \( F_{\text{obs.}} = 0.65 \quad F_{\text{tab.}} = 3.95^+ \)

Observation:
The null hypothesis is not rejected.

Conclusion:
The interaction effect of sex and parental education on achievement is not significant.

Study 10: Motivation x Parental Education Vs Achievement

H₁₀: There is no significant effect of the interaction of motivation and parental education on the achievement of students.

Data: \( F_{\text{obs.}} = 0.18 \quad F_{\text{tab.}} = 3.95^+ \)

Observation:
The null hypothesis is not rejected.

Conclusion:
The interaction effect of motivation and parental education on achievement is non-significant.

Study 11: CTM x Sex x Motivation Vs Achievement

H₁₁: There is no significant effect of the interaction of CTM, Sex and Motivation on the achievement of students.
Data: $F_{\text{obs.}} = 0.35$, $F_{\text{tab.}} = 3.95^+$

Observation:
The null hypothesis is not rejected.

Conclusion:
The interaction effect of CTM, Sex and Motivation on achievement is non-significant.

Study 12: CTM x Sex x Parental Education Vs Achievement

$H_{12}$: There is no significant effect of the interaction of CTM, sex and Parental Education on the achievement of students.

Data: $F_{\text{obs.}} = 2.22$, $F_{\text{tab.}} = 3.95^+$

Observation:
The null hypothesis is not rejected.

Conclusion:
The interaction effect of CTM, Sex and Parental Education on achievement is not significant.

Study 13: CTM x Motivation x Parental Education Vs Achievement

$H_{13}$: There is no significant effect of the interaction of CTM, Motivation and Parental Education on the achievement of students.

Data: $F_{\text{obs.}} = 0.59$, $F_{\text{tab.}} = 3.95^+$

Observation:
The null hypothesis is not rejected.
Conclusion:
The interaction effect of the interaction of CTM, Motivation and Parental Education on achievement is not significant.

Study 14: Sex x Motivation x Parental Education Vs Achievement

$H_{14}$: There is no significant effect of the interaction of sex, Motivation and Parental Education on the achievement of students.

Data: $F_{\text{obs.}} = 0.22 \quad F_{\text{tab.}} = 3.95^+$

Observation:
The null hypothesis is not rejected.

Conclusion:
The interaction effect of sex, Motivation and parental education on achievement is non-significant.

Study 15: CTM x Sex x Motivation x Parental Education Vs Achievement

$H_{15}$: There is no significant effect of the interaction of CTM, Sex, Motivation and parental Education on the achievement of students.

Data: $F_{\text{obs.}} = 0.96 \quad F_{\text{tab.}} = 3.95^+$

Observation:
The null hypothesis is not rejected.
Conclusion:

The interaction effect of CTM, Sex, Motivation, and Parental Education on achievement is not significant.

Study 16: Treatment Vs attitude

\( H_{16} \): There is a significant difference between the attitudes of experimental group and control group.

The null form of the hypothesis was tested.

Data:

\[ F_{\text{obs.}} = 12.66 \quad F_{\text{tab.}} = 6.92^{++} \]

\[ M_{A_1} = 3.27 \quad M_{A_2} = 3.53 \]

Observation:

1. The null hypothesis was rejected.
2. \( M_{A_1} < M_{A_2} \)

Conclusion:

1. There is significant effect of CTM on attitude.
2. The experimental group has a greater degree of positive attitude towards mathematics than the control group.

Study 17: Sex Vs Attitude

\( H_{17} \): There is no significant difference between the attitudes of Boys and Girls.

Data:

\[ F_{\text{obs.}} = 0.37 \quad F_{\text{tab.}} = 3.95^+ \]

Observation:

The null hypothesis is not rejected.
Conclusion:
There is no significant difference between the attitudes of Boys and Girls.

Study 18: Motivation Vs Attitude
H₁₈: There is no significant difference between the attitudes of low motivation group and high motivation group.

Data:
\[ F_{obs.} = 47.22 \quad F_{tab.} = 6.92^{++} \]
\[ M_{C₁} = 3.21 \quad M_{C₂} = 3.60 \]

Observation:
The null hypothesis was rejected.

Conclusion:
1. There is significant difference between the attitudes of low motivation group and high motivation group.
2. \( M_{C₁} < M_{C₂} \)
3. The high motivation group has greater positive attitude towards mathematics than the low motivation group.

Study 19: Parental Education Vs Attitude
H₁₉: There is no significant difference between the attitudes of low parental education group and high parental education group.

Data:
\[ F_{obs.} = 55.07 \quad F_{tab.} = 6.92^{++} \]
\[ M_{D₁} = 3.13 \quad M_{D₂} = 3.67 \]
Observation:
The null hypothesis was rejected.

Conclusion:
1. There is significant difference between the attitudes of low parental education group and high parental education group.
2. \( M_{D_1} < M_{D_2} \)
3. The high parental group has greater positive attitude towards mathematics than low parental education group.

Study 20: CTM x Sex Vs Attitude

\( H_{20} : \) There is no significant effect of the interaction of CTM and Sex and the attitudes of students.

Data: \( F_{obs.} = 0.31 \quad F_{tab.} = 3.95^* \)

Observation:
The null hypothesis is not rejected.

Conclusion:
The interaction effect of CTM and sex on the attitude is not significant.

Study 21: CTM x motivation Vs attitude

\( H_{21} : \) There is no significant effect of the interaction of CTM and motivation on the attitudes of students.

Data: \( F_{obs.} = 0.55 \quad F_{tab.} = 3.95^* \)
Observation:  
The null hypothesis is not rejected.

Conclusion:  
The interaction effect of CTM and motivation on attitude is not significant.

Study 22: CTM x Parental Education Vs Attitude  

$H_{22} :$ There is no significant effect of the interaction of CTM and Parental Education on the attitude of students.

Data: $F_{\text{obs.}} = 1.72$  

$F_{\text{tab.}} = 3.95'$

Observation:  
The null hypothesis is not rejected.

Conclusion:  
The interaction effect of CTM and parental education on attitude is not significant.

Study 23: Sex x Motivation Vs attitude  

$H_{23} :$ There is no significant effect of the interaction of sex and motivation on the attitude of students.

Data: $F_{\text{obs.}} = 11.32$  

$F_{\text{tab.}} = 6.92''$

Conclusion:  
The null hypothesis was rejected.

Conclusion:  
The interaction effect of sex and motivation on students' attitude was significant.
Study 24: Sex x Parental Education Vs Attitude

H_{24} : There is no significant effect of the interaction of sex and parental education on the attitude of students.

Data: \( F_{\text{obs.}} = 0.50 \quad F_{\text{tab.}} = 3.95 \)

Observation: The null hypothesis is not rejected.

Conclusion: The interaction effect of sex and parental education on attitude is not significant.

Study 25: Motivation x Parental Education Vs Attitude

H_{25} : There is no significant effect of the interaction of motivation and parental education on the attitude of the students.

Data: \( F_{\text{obs.}} = 11.66 \quad F_{\text{tab.}} = 6.92 \)

Observation: The null hypothesis was rejected.

Conclusion: The effect of interaction of motivation and parental education on attitude was significant.

Study 26: CTM x Sex x Motivation Vs Attitude

H_{26} : There is no significant effect of the interaction of CTM, Sex and Motivation on the attitudes of students.

Data: \( F_{\text{obs.}} = 1.51 \quad F_{\text{tab.}} = 3.95 \)
Observation:
The null hypothesis is not rejected.

Conclusion:
The interaction effect of CTM, sex and motivation on attitude was not significant.

Study 27: CTM x Sex x Parental Education Vs Attitude

H27: There is no significant interaction effect of CTM, sex and parental education on the attitude of students.

Data: $F_{obs.} = 0.46$ $F_{tab.} = 3.95^*$

Observation:
The null hypothesis is not rejected.

Conclusion:
The interaction effect of CTM, sex and parental education on attitude is not significant.

Study 28: CTM x Motivation x Parental Education Vs Attitude

H28: There is no significant effect of the interaction of CTM, Motivation and Parental Education on the attitude of students.

Data: $F_{obs.} = 0.006$ $F_{tab.} = 3.95^*$

Observation:
The null hypothesis is not rejected.

Conclusion:
The interaction of effect of CTM, Motivation and Parental Education on attitude is not significant.
Study 29: Sex x Motivation x Parental Education Vs Attitude

$H_{29}$: There is no significant effect of the interaction of sex, motivation and parental education on attitude is not significant.

Data: $F_{\text{obs.}} = 4.75 \quad F_{\text{tab.}} = 3.95^*$

Observation:

The null hypothesis was rejected.

Conclusion:

The interaction effect of sex, motivation and parental education on attitude is significant.

Study 30: CTM x Sex x Motivation x Parental Education Vs Attitude

$H_{30}$: There is no significant effect of interaction of CTM, Sex, Motivation and Parental Education on the attitudes of students.

Data: $F_{\text{obs.}} = 0.12 \quad F_{\text{tab.}} = 3.95^+$

Observation:

The null hypothesis is not rejected.

Conclusion:

The interaction effect of CTM, sex, motivation and parental education on attitude is not significant.
7.4 Findings and Discussion:

A brief summary of the findings were listed below:

1. The CTM had significant effect on both the achievement and attitude of the students. The achievement and attitude towards mathematics of the experimental group showed considerable improvement.

2. Though boys and girls differed in achievement, their attitudes did not differ significantly.

3. The first order interaction of sex and motivation was significant for both achievement and attitude.

4. Classroom observations of the investigator indicated the successful use of the model.

The above findings are in general agreement with the trends in research in mathematics education. The CTM was based on Williams' model, which was field tested in United States. It was found to be effective in improving the creativity of children. Since the model aims at improving the four cognitive behaviours and four affective behaviours it is natural that it had positive effect on achievement and attitude of children.

Though girls displayed the same degree of positive attitude towards mathematics, they lagged behind in achievement. There may be many other causes peculiar to the group.
For example in Indian homes girls usually share the burden of domestic work with their mothers. They become tired and often fail to study at home. The real causes are to be investigated.

The model worked well and produced the desired results. It improved both the achievement and attitude of the students. This can be seen in the case of students belonging to high Parental Education Group. Study 19 shows a very high value of F.

7.5 Educational Implications:

There is little impact of research in education on classroom teaching. The reasons are many. Lack of communication is one. The reluctance of teachers to change their ways is another. Since the system of education in India is highly centralised there is no scope for teacher initiation. Programmes like CTM could be profitably used by teachers with a little additional effort.

1. It does not need any costly or elaborate equipment. The usual teaching aids like colour paper, blackboard etc., are enough.

2. One need not disturb the official plan or need additional time.

3. The teacher can build these ideas into his daily lesson plans wherever appropriate.
4. The traditionally used method of teaching mathematics, namely example - exercise sequence can be partly replaced by the teacher modes of behaviour like skills of search, provocative questions and others.

5. It can bring a change in the outlook of the teacher, and makes him more creative.

6. Since motivation is an internal condition of the learner the programme benefited the high motivation group. It has generated positive attitude towards mathematics in the high motivation group to a high level.

7.6 **Direction for future research:**

1. The CTM had covered only a part of the content prescribed for IX class students of Andhra Pradesh. It can be expanded to include all the topics.

2. Similar programmes could be prepared for other classes and for other subjects.

3. Since this model functions on the basis of three-way interaction of pupils, teachers and content it may have effect on the teacher's personality. This can be investigated.

4. Out of the 18 strategies developed by Williams only 9 were selected for this experiments. The other modes also could be tried.

This chapter contains the classroom observations, Statistical observations, discussion of the findings and direction for future research.