CHAPTER VI
SUMMARY

6.1. INTRODUCTION

The Indian Education Commission (1964-1966) stated that the destiny of India should be shaped in the classroom and envisages that it will best serve the developmental needs of the society and universalisation of Education. If this is to happen, then it is necessary that we build a system, which will help in fostering of talented individuals and utilize their potentials in full for the economic prosperity of our nation. The economic prosperity and development of society is based on Science and Technology and its impact on society and development of society goes parallel, and interdependent. Science and Technology contributes solutions to the problems of the country by developing desirable understanding, attitudes, skills, and abilities. The role of science, teaching of science is of utmost importance in the process of development and transformation of society.

6.2. COMPETENCE IN TEACHING SCIENCE

The term 'Competence is a generic word that represents the following three levels of human functioning' (i) Knowledge (ii) attitude and (iii) Performance Skill. A Program could be based on Competency Statement in one or more of the following components (a) its planning and design (b) its training materials (c) its training procedures and (d) its evaluation. The word Competency is taken in the broad Sense of knowledge, attitudes, Skills and behaviours that facilitate intellectual, Social, emotional and physical growth in children (Weber. 1972)
6.3. COGNITIVE INTERVENTION STRATEGIES

The term "teaching competency" as defined by Flanders and Simon (1969) includes more than mere teacher effectiveness and pupil outcomes. According to Hewkew (1956) and Wilson (1973), it includes knowledge, attitude, skill and other teacher characteristics. Medley and Mit (1963) and Biddle perceive "teacher competence" as teacher behaviour that produce intended effects. Rama (1979) gives a comprehensive definition of the term teaching competency as the ability of a teacher manifested through a set of overt teacher classroom behaviour. In other words it is a set of observable teacher behaviours that bring about pupil learning. Hence for the purpose of this study "teaching competency" would mean "effective performance of all observable teacher behaviours that bring about desired pupil outcomes".

A strategy is composed of "Cognitive operation over and above the Processes that are natural consequences of carrying out the task, ranging from one such operation to a sequence of interdependent operation". Strategies achieve cognitive purpose. (e.g. Comprehending, memorizing).

Celiger (1982) defined strategy as a set of abstract cognitive functions, which are used to acquire knowledge, which are biologically determined independent and constant.

- Chunking
- Spatial learning
- Concept mapping
- Advance Organizer.
6.4. RATIONALE FOR THE STUDY

Teacher Education at elementary level is Competence-Based Commitment-oriented Teacher Education (CBTE). 663 competencies are identified in all subjects particularly 103 competencies in science teaching at elementary level. But elementary school children have not attained the optimum level about competence. Because teachers at elementary level, have not used proper teaching strategies. Particularly teaching of science at elementary level is very important, because of developing scientific attitude, problem-solving ability and scientific temper.

Science teachers should have adequate knowledge about teaching competencies like planning, set induction, instructional logistics, communication, motivation, questioning strategies, responding behavior, audio-visual supports, reinforcement, classroom management, situational evaluation and knowledge of subject matter. So the competencies should be developed at the time of their pre-service training. Today's teacher trainees are future elementary teachers. During of pre-service training, student teachers need the above competencies in teaching of science.

The improvement of educational system depends upon the teacher and their education. In the present education system, cognitive area is more emphasized than the area of affective goals. The progress is to be achieved in
refining the attitudes and the institution of teacher education must be made more effective in helping teachers to develop competence.

The present study was undertaken since the teaching competence is dependent on cognitive area. Using the cognitive strategies, teaching competence can be developed.

6.5. STATEMENT OF THE PROBLEM

Development of a nation depends on the quality of education imparted to the students in classroom. Quality in education depends mainly on teachers, that too on the competent teacher. Precisely the term competent teacher refers to the teacher who possesses a set of elements which lead not only to develop a skill but a good combination of knowledge, understanding, and attitudes. To become an adequately competent teacher he/she must have positive attitude towards himself/herself and also towards teaching-learning process.

Teacher trainees at DTE level know the scientific terms, concepts, principles and formulae to apply them in practical life situation. They develop and use the appropriate instructional skill in science and also develop scientific attitude and scientific temper. Teacher trainees can adopt innovative teaching methods and suitable teaching activities.

Instead of making the teacher trainees simply reproduce the textual materials with or without understanding, the investigator hopes that if the cognitive strategies are effectively used, the competence could be developed. This study will go a long way in making innovative teaching and learning of science for a purposeful and meaningful activity. Hence, the problem in the
present study is stated thus: "EFFECTIVENESS OF COGNITIVE INTERVENTION STRATEGIES ON DEVELOPING COMPETENCE IN TEACHING SCIENCE AMONG DTE STUDENTS".

6.6. OBJECTIVES

To identify the level of competency in teaching science among teacher trainees

➢ To design a model on cognitive intervention strategies to enhance competency in teaching science

➢ To develop science teaching competency through cognitive intervention strategies among teacher trainees

➢ To find the effectiveness of cognitive intervention strategies on developing competency in teaching science among teacher trainees

6.7. ASSUMPTIONS

➢ Teacher trainees could be given guidance towards teaching of science.

➢ Teacher trainees in DIET adopt some strategies to teach science.

➢ Cognitive intervention strategies may be effective on developing competency in teaching science.

➢ The cognitive intervention strategies may help the trainee teachers to teach science more effectively in the classroom.

➢ It is possible to design and develop cognitive intervention strategies to enhance competency in teaching science.

➢ Developing competency in science teaching may increase achievement level of the students.
The competency in science teaching of the teacher trainees can be assessed.

There is significant correlation between competence in teaching science and cognitive intervention strategies.

6.8. HYPOTHESES

The following research hypotheses were formed in this study.

- There is significant-meaning difference between the Pre-test and Post-test scores on competence in teaching science among DTE students.
- There is significant mean difference between the Pre and Progressive assessment by peer group scores on competence in teaching science among DTE students.
- There is significant mean difference between the Pre and Progressive assessment by researcher's scores on competence in teaching science among DTE students.
- There is significant mean difference between the Pre and Progressive self-assessment scores on competence in teaching science among DTE students.
- There is significant mean difference between the progressive test scores on competence in teaching science by self-assessment and peer group assessment.
- There is significant mean difference between the progressive test scores on competence in teaching science by peer group assessment and investigator assessment.
• There is significant mean difference between the progressive test scores on competence in teaching science by self-assessment and investigator assessment.

• There is significant mean difference between the Pre and Post assessment scores on Cognitive Intervention Strategies among DTE students.

• There is significant mean difference between pre and progressive assessment scores on cognitive intervention strategies.

• There is significant mean difference between the progressive and post assessment scores on cognitive intervention strategies among DTE students.

6.9. DELIMITATION

This study is confined only to District Institute of Education and Training, Pudukkottai.

- This study is confined only to Teacher Trainees of First year "B" section.
- All the 30 students in the 'B' section form the sample of this study.
- This study is confined to all the 30 students in the 'B' section comprising 12 Boys and 18 Girls.
- This study is conducted in eight weeks in order to complete Teaching Science. Cognitive strategy adopted to develop teaching competence in the form of programmers in the classroom.
6.10. SAMPLE

a) Location

The present investigation was conducted in District Institute of Education and Training, Pudukkottai.

b) Selection of the Sample

All the 30 Teacher Trainees of first year ‘B’ section formed the sample of the study. Single group and purposive sampling techniques was followed:

6.11. EXPERIMENTAL DESIGN

The Research design is the conceptual structure of the research procedure. It provides planning on selection of subjects, data gathering devices, data analysis techniques in relation to objectives of research.

The Experimental method is clearly for determining the casual’s effect of an isolated, single variable on dependent variable. It provides a systematic and logical way for answering the research questions. It is to establish cause and affect relationship between variables. This method is considered to provide for a high degree of control over extraneous variables and the manipulation of variables. It helps to test hypotheses of casual relationship between variables. It also permits drawing inference about causality.

Experimental research enables the researcher to go beyond description and prediction beyond identification of relationships to partial determination of what causes them. The immediate purpose of experimentation is to predict events in the experimental setting. Based on the above advantages of experimental research, the investigator has adopted an experimental design for the present investigation.
Single Group Pre-Test, Post-Test Design

Experimental designs are unique to the experimental method. They serve as positional and statistical plans to designate relationship between experimental treatments and the experimenter's observations or measurement points in the temporal scheme of the study. Judicious selection of the design improves the probability that the observed change in the dependent variable was caused by the manipulation of the independent variable and not by other factors. It simultaneously strengthens the generalizability of results beyond the experimental setting. (Schuman, Jahoda, Deutsht)

The one group method is the elementary and least rigorous design. The researcher selected this design for the following reasons.

- Being the class teacher for this group of students, this group of students is readily available for close observation of their progress.
- Conducting the experiment is a time consuming process, the researcher would like to carry out the research without affecting his routine academic work.

As the teacher trainees have to undergo school observation study for fifteen days and teaching practice for forty days, the students' level of competence should assessed by investigator and peer group teacher trainees. Hence, the groups of students are selected to undergo the experimentation.
6.12. VARIABLES

The present investigation is an attempt to determine the "Effectiveness of cognitive intervention strategy on developing competence in teaching science among DTE students" the variables involved are

a. Independent variable

Cognitive intervention strategy is an independent variable in the present investigation.

B. Dependent variable

Competence in teaching Science is the dependent Variable.
6.13. EXPERIMENTATION IN PHASES

Identifying Components of Cognitive Intervention Strategies

Developing Cognitive Intervention Strategies on Competence in teaching science

Administering Pre-Test on Cognitive Intervention Strategies on Competence in teaching science

Theoretical Orientation
1. Cognitive Intervention Strategies
2. Competence in teaching science

Treatment (Cognitive Intervention Strategies on Competence in teaching science)

Demonstration of the model of Cognitive Intervention Strategies on developing competence in teaching science

Administering Post - Test on Cognitive Intervention Strategies on Competence in teaching science

Statistical treatment of the data analysis

Findings
The intervention strategies were developed and implemented to the student teachers in the following experimentation phases.

Phase I: SAMPLE SELECTION

The school teachers at secondary level are trained in teaching, methodology and technology during the training period, they are not competent enough to teach science subject at secondary level. It was also found that trainees scarcely adopt cognitive intervention strategies. It is difficult to teach the cognitive intervention strategies in teaching of science during the in-service programme to school - teachers. It is also useful and effective to enhance competence in the developing teachers if they are ready to accept the training strategies. The investigator, being a teacher educator, selected 30-teacher trainee's batch (2004-2005) from first year.

Phase II: SELECTING STRATEGIES

a) COGNITIVE INTERVENTION STRATEGIES

Cognition is highly a mental process that transforms the sensory input in various ways code it, store it in memory and retrieve it for later use. Cognition refers to the process whereby an individual obtain knowledge about perceiving, remembering, discriminating, evaluating, imaging, thinking, creating and problem solving. A strategy is plan of action and composed of cognitive operation over and above the processes that are natural consequences of carrying out the task, ranging from one such operation to a sequence of interdependent operation. According to Weinstein and Mayer (1986), cognitive strategies operate directly on incoming information manipulating it in ways that enhance learning.
During the formation and construction of scale to assess cognitive intervention strategies the investigator referred and followed some relevant information about cognition, cognitive abilities, cognitive processes, cognitive learning, and cognitive elements of teaching behaviour, cognitive theory development, cognitive strategies, Memory strategies, biological cognition, physiological cognition and sociological cognition. Based on these information the investigator developed a “cognitive intervention strategies scale” (Annexure – II) with the help of educational experts. The scale consists of 8 dimensions and 26 items, they are:

Table – 2
DIMENSION OF COGNITIVE INTERVENTION STRATEGIES AND NUMBER OF ITEMS

<table>
<thead>
<tr>
<th>SL.NO</th>
<th>Dimensions</th>
<th>Number of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chunking</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Spatial Learning</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Concept mapping</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Advance organizer</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Metaphor</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Rehearsal</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Imagery</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>Mnemonics</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>Total Items</strong></td>
<td><strong>26</strong></td>
</tr>
</tbody>
</table>

b) CONSTRUCTION OF SCALE TO ASSESS COMPETENCE IN TEACHING SCIENCE

Competence is an improved modern term applied to the way of doing things is the competent way; the right way to perform a job, the right way to live and work in association and co-operation with others. Competence does not result from possession of great amount of knowledge. It must be integrated into a
pattern of behavior to serve a useful purpose. Flanders and Simon (1969) defined the term “teaching competence” as one, which includes more than teacher effectiveness and pupil outcomes. According to Copper (1973) “Teacher competencies are the resultant of attitudes, understanding, skill and behaviors that facilitates intellectual, social, emotional and physical growth in children. During the formation and construction of scale to assess competence in teaching science the investigator revised some relevant information about competencies like teaching competence, teacher competence, characteristics of competent teacher, pre-service training and teacher competence, concept of competency. Based on Teacher Education, some classification of competencies, strategies for evaluation of teaching competencies, competencies by functional level, competencies by area of application, some factors affecting teaching competence based on these information’s the investigator developed a “competence in Teaching Science scale” (Annexure – II) with the help educational experts consists of twelve dimensions and 45 items, they are:

6.14. CONSTRUCTION AND VALIDATION OF TOOLS

Pre – Assessment Tool of Competence

The Pre – assessment of the level of competence in Teaching Science among DTE Students is assessed through a scale which contains forty five (45) items under twelve (12) major headings viz,
Table - 3
DIMENSION OF COMPETENCE IN TEACHING SCIENCE AND NUMBER OF ITEMS

<table>
<thead>
<tr>
<th>SL.NO</th>
<th>Dimensions</th>
<th>Number of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Planning</td>
<td>5</td>
</tr>
<tr>
<td>2.</td>
<td>Set Induction</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>Instructional techniques</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>Communication</td>
<td>5</td>
</tr>
<tr>
<td>5.</td>
<td>Motivation</td>
<td>4</td>
</tr>
<tr>
<td>6.</td>
<td>Questioning strategies</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>Responding behaviour</td>
<td>3</td>
</tr>
<tr>
<td>8.</td>
<td>Audio-visual support</td>
<td>4</td>
</tr>
<tr>
<td>9.</td>
<td>Reinforcement</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>Classroom management</td>
<td>4</td>
</tr>
<tr>
<td>11.</td>
<td>Situational evaluation</td>
<td>4</td>
</tr>
<tr>
<td>12.</td>
<td>Knowledge of subject matter</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Total Items</td>
<td>45</td>
</tr>
</tbody>
</table>

Preparation and Scoring of Items

Competence in teaching Science Scale were identified the basis of consultation done with experts is the field of education. Having the components presented above as the frame of reference sixty statements was graded on a four-point scale. The highest score for each statement is three and the lowest score is zero.

Progressive – Assessment Tool of Competence in Teaching Science

The same tool of competence in teaching science were used is progressive assessment. During the period of teaching practice this tool was assessed by the trainees, peer group trainees, and the investigator.

Post – Assessment Tool of Competence in Teaching Science:

Same tool were used by the investigator in the Post – assessment.
The level of cognitive intervention strategies of the DTE students is assessed through a pre-test questionnaire which contains twenty seven (27) items under eight (8) major heading viz,

- Chunking
- Spatial learning
- Concept mapping
- Advance Organizer
- Metaphor
- Rehearsal
- Imagery
- Mnemonics

**Preparation and Scoring of Items**

Cognitive Intervention Strategies Scale were identified on the basis of consultation done with experts in the field of education especially cognitive Science. Keeping the above components in mind, the frame of reference (twenty seven statements) were prepared. This statements were graded on a four point scale.

The responses of the teacher trainees were assessed using the following 3-0 scale:

<table>
<thead>
<tr>
<th>Description</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td>0</td>
</tr>
<tr>
<td>To some extent</td>
<td>1</td>
</tr>
<tr>
<td>To a greater extent</td>
<td>2</td>
</tr>
<tr>
<td>To the greatest extent</td>
<td>3</td>
</tr>
</tbody>
</table>
Pre – Assessment

The level of Cognitive Intervention Strategies of the Subjects was assessed at the beginning, before the experimentation was conducted using the tool developed by investigator and the scores were recorded the pre assessment of Cognitive Intervention Strategies.

Post – Assessment

After the treatment, the same Cognitive Intervention Strategies tool were used by investigator and the score were recorded.

VALIDATION OF TOOLS

The investigator reviewed literature on the procedures of evaluating the teaching competence of teacher trainees. The investigator also consulted experts in the field of teacher education. After gaining the relevant information and suggestions, the researcher applied his personal experience and felt the need for developing the tool, as the existing tools were varying in nature to administer. A brief description about the importance of rating scale, precaution to be taken to construct it, limitation and the reasons for choosing it are explained here under:

Based on the above-mentioned criteria, the investigator administered the scale to measure the competence in teaching science (dependent variable) and cognitive intervention strategies (independent variable). The validations of tools used are the following.

i) Competence in teaching science scale

ii) Cognitive Intervention strategies scale (Developed and validated by investigator)
In order to establish, whether the listed items really tailed under the specific category, the items were arranged in a random order and subjected to experts' scrutiny. The experts were drawn from the field of teacher education. Based on the experts' opinion, items of the competence in teaching science and cognitive intervention strategies rating scale were modified. Thus, the face validity was also established. The items of the competence of teaching science scale were selected by using the item analysis. The cognitive intervention strategy scale was validated by using item analysis procedure.

RELIABILITY OF THE TOOLS

The reliability of the tools was established by KR 20 method. The reliability of the scale to measure cognitive intervention strategy is 0.85 and the reliability of the scale to measure competence in teaching science is 0.87

Phase III: Conducting a Pre Test

After conducting orientation programme about cognitive intervention strategies and competence in teaching science to assess the present level of cognitive intervention strategies and competence in teaching science, tools were used. These tools are constructed and validated by the investigator with the help of educational experts. Investigator assessed the competence in teaching science and cognitive intervention strategies of teacher trainees and the scores were averaged to get the average performance. The same tools were repeated in the post-test on cognitive intervention strategies and competence in teaching science.
Phase IV: TREATMENT

6.15. DURATION OF THE EXPERIMENT

The duration of experiment was two months

<table>
<thead>
<tr>
<th>I Week</th>
<th>Selection of the Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>II Week</td>
<td>Tool Construction</td>
</tr>
<tr>
<td>III Week</td>
<td>Pre Assessment of the Variables, Competence in teaching science and Cognitive Intervention Strategies</td>
</tr>
<tr>
<td>IV Week</td>
<td>Treatment (Theoretical Orientation on Competence in teaching Science</td>
</tr>
<tr>
<td>V Week</td>
<td>Treatment (Theoretical Orientation on Cognitive Intervention Strategies</td>
</tr>
<tr>
<td>VI Week</td>
<td>Demonstration on Competence in teaching Science Developed by Cognitive Intervention Strategies</td>
</tr>
<tr>
<td>VII Week</td>
<td>Progressive assessment (Competence in teaching Science assessed by self, peer group and investigator)</td>
</tr>
<tr>
<td>VIII Week</td>
<td>Post Assessment of Competence in teaching Science and Cognitive Intervention Strategies</td>
</tr>
</tbody>
</table>

a) Theoretical orientation on competence in teaching science

After conducting a pre-test the investigator conducted theoretical orientation programme on competence in teaching science to teacher trainees. During this period investigator detailed about competence, teaching competence, teacher competence, competence in teaching science and various dimensions of competence in teaching science like planning, set induction, instructional techniques, communication, Motivation, Questioning Strategies, Responding behaviour, Audio-Visual support, Reinforcement, classroom Management, Situational evaluation and knowledge of subject matter.

b) Theoretical orientation on cognitive intervention strategies

After conducting a pre-test the investigator conducted theoretical Orientation programme on cognitive intervention strategies to teacher trainees.
Before the starting of orientation programme the trainees are never aware of cognitive intervention strategies. During this treatment period the investigator explained in detail about cognition, cognitive processes, cognitive strategies and various demission of cognitive intervention strategies like chunking, spatial learning, concept mapping, advance organizer metaphor, rehearsal, imagery and mnemonics. These strategy help to develop competence in teaching science.

**Phase V: DEMONSTRATION ON COMPETENCE IN TEACHING SCIENCE DEVELOPED BY COGNITIVE INTERVENTION STRATEGIES**

Model for competence in teaching science was developed by investigator. This model was demonstrated by investigator through classroom teaching. The teacher trainees were allowed to practice these competencies in teaching science through cognitive intervention strategies during the teaching practice period.

**Phase VI: PROGRESSIVE ASSESSMENT**

During the time of teaching practice competence in teaching science was assessed by self-peer group and investigator through the competency score. At the same time cognitive intervention strategies scores was assessed by investigator with the help of self-opinion.

**Phase – VII: CONDUCTING POST – TEST**

Post – test was conducted by investigator after implementation of treatment. During the post – test the same cognitive intervention strategies scale and competence in teaching science scale was used.
Phase – VIII: DATA ANALYSIS

Data collected in pre – test, progressive test and post – test were analysed using appropriate statistical techniques.

6.16. DATA COLLECTION

Cognitive intervention strategy scale (CS) developed by investigator and administered among 30, DTE student teachers. Pre assessment scores on cognitive intervention strategy (CS1) were collected. Scale to assess competence in teaching science (CT) was constructed and validated by the investigator. This scale was used to assess competence in teaching science (CT1) were collected.

Treatment was given to the student teachers for a period of two weeks. Progressive assessment scores on competence in teaching science scale assessed by self (CT11), peer group (CT12) and investigator (CT13). Progressive assessment scores on competence in teaching science scale assessed by investigator (CS11) were converted into percentage scores.

The post assessment scores on cognitive intervention strategy scale (CS2) were collected and the post assessment scores on competence in teaching science scale (CT2) among student teachers were collected. All the scores on cognitive intervention strategy (CS) and competence in teaching science (CT) are converted into percentage scores for comparison purpose. All the scores were computed for analysis.
In the present study, the relevant data obtained from assessment scores on the pre, progressive and post assessment on competence in Teaching science (CT) and cognitive intervention strategies (CS) secured by 30 student teachers have been analyzed as follows.

A. Descriptive Analysis

It provides information about the nature of a particular group of individuals. Mean and standard deviation was calculated for pre assessment, progressive assessment and post assessment on competence in teaching science and cognitive intervention strategies.

B. Differential Analysis

It provides inferences involving determination of statistical significance of difference among the students with reference to selected variables

i) Competence in teaching science and

ii) Cognitive intervention strategies.

These scores involves 't' test.

C. Correlation Analysis

Correlation analysis aims finding out the relationship between two variables. The product moment correlation was to find the relationship between competence in teaching science and cognitive intervention strategies.
D. Correlation Matrix

This kind of analysis was used to analyze the interrelationships among the correlated variables. It is used to correlate various assessments on selected variables.

E. Non Parametric Analysis

Kruskal wallis one way ANOVA.

This test is a direct generalization of the Mann-Whitney test to the case in which have three or more independent variables. This test to find out whether there was difference in the effectiveness of the three variables.

6.18. FINDINGS

➤ The competence in teaching science is enhanced during and after the treatment

➤ There is 25.7% increase in the mean scores of competence in teaching science from pre-test to progressive test by self assessment, 27.6% increase in the mean scores from pre-test to progressive test by peer group assessment, 28.57% increase in the mean scores from pre-test to progressive test by investigator assessment and 37.27% increase in the mean scores from pre-test to post-test

➤ The level of cognitive intervention strategies is increased. There is 35.33% increase in the mean scores from pre-test to progressive test and 20.16% increase in the mean scores from pre-test to post-test
All the 't' values between the pre, progressive and post-tests of competence in teaching science are significant at 0.05 level. This shows the enhancement in the level of competence in the level of competence in teaching science from pre-test to post-test through progressive tests.

All the 't' values between the pre, progressive and post-test of cognitive intervention strategies are significant at 0.05 level. This shows the increase in the level of cognitive intervention strategies from pre-test to post-test.

The stepwise kruskal-wallis chi-square test reveals that the contribution of the independent variables on enhancing the competence in teaching science at different assessment. The contribution of cognitive intervention strategies is greater on enhancing the competence in teaching science in the progressive test and the post-test. This reveals the effectiveness of cognitive intervention strategies on enhancing the competence in teaching science.

6.19. DISCUSSION

The mean score of competence in teaching science in progressive test by self-assessment (93.16) is greater than that of pre-test (67.46). There is significant difference between pre-test and progressive test by self-assessment on competence in teaching
science among teacher trainees. The difference in the mean scores is due to effect of implementing cognitive intervention strategies.

- The mean scores of competence in teaching science in progressive test by peer group assessment (95.06) is greater than that of the pre-test (67.46). There is significant difference between pre-test and progressive test by peer group assessment on competence in teaching science among teacher trainees. The increase in the mean scores is due to effect of implementing cognitive intervention strategies.

- The mean score of competence in teaching science in progressive test by investigator assessment (96.03) is greater than that of the pre-test (67.46). There is significant difference between pre-test and progressive test by investigator assessment on competence in teaching science among teacher trainees. The increase in the mean scores is due to effect of implementing cognitive intervention strategies.

- The mean scores of competence in teaching science in post-test (104.73) is greater than that of pre-test (67.46). There is significant difference between pre-test and post-test on competence in teaching science among teacher trainees. The increase in the mean scores is due to influence of implementing cognitive intervention strategies.
> The mean scores of cognitive intervention strategies in progressive test (69.33) is greater than that of pre-test (34.00). There is significant difference between pre-test and progressive test on cognitive intervention strategies among teacher trainees. The increase in the mean scores is due to influence of implementing orientation programme about cognitive intervention strategies during classroom teaching.

> The mean scores of cognitive intervention strategies in post-test (54.16) is greater than that of pre-test (34.00). There is significant difference between pre-test and post-test on cognitive intervention strategies among teacher trainees. The increase in the mean scores is due to influence of implementing orientation programme about cognitive intervention strategies during classroom teaching.

> There is correlation between the scores of cognitive intervention strategies and competence in teaching science in all the pre, progressive and post assessments.


6.20. EDUCATIONAL IMPLICATIONS

Researches have proved that cognitive intervention strategies are the important components of intelligence memory and academic success. Cognitive intervention strategies play a significant role in the students' success. Students who considered their options and reflected on their strengths in relation to their goals achieved success.

The role of cognitive process of learning is activated only by suitable interventions. Learning is two fold; one is learning of skill, another one is learning new knowledge. In educational institutions, there is less focus on cognitive intervention strategies. The study reveals that the teacher trainee's competence in teaching science adopting cognitive intervention strategies could be improved. For there the intervention strategies have to be suitably selected and adopted.

The influence of cognitive intervention strategies is found to be effective in enhancing competence in teaching science. Hence, the student teachers of all DIET, college of education could be asked to practice cognitive intervention strategies to enhance their competence in teaching science.
One of the institutional awareness of curriculum framework and syllabus design found based on cognitive intervention strategies on the beginning level, can improve teaching of science, learning science and scientific temper among all level students.

The results obtained from present study shows that teacher trainees used cognitive intervention strategies in the classroom teaching it helped to identification and planning of problem, awareness and selection of suitable strategies, adopting them and improving them own efficiency.

6.21. SUGGESTION FOR FURTHER RESEARCH

To over come the limitation of the present study and to extend the research findings of the study, a few suggestions are given below for further research.

➢ The present study was conducted to first year DIET students, Pudukkottai.
   The study may be conducted to second year DIET students of the Diploma course.

➢ The present study was confined to enhance the level competencies. Only the study may be done with respect to other competencies also.

➢ The present investigation was carried out to find the effectiveness of cognitive intervention strategies on enhancing competence in teaching science alone. It is suggested to the study with other subject like teaching Mathemetic, teaching social studies, etc

➢ The study is confined to the DIET students who are the future primary teachers. This study may be conducted among the B.Ed., teacher trainees also.
It is suggested to this study at elementary, higher secondary school and even in higher education levels.

The study may also be conducted in the DIETs of various districts.

6.22. CONCLUSION

The cognitive intervention strategy adopted to improve competence in teaching science has resulted in overall improvement in different dimensions in the post-test (28%). In addition to the enhancement of teacher trainees competence in teaching science, their competence in adopting cognitive strategy has also improved substantially in the post test (25%).

The enhancement (34%) in the post-test on responding behaviour reveals that the teacher trainees competence in teaching science has improved. For the teaching of science, the seeking of new information and the inquisitive attitude are very essential. This is followed by reinforcement with the enhancement of 31% in the post test. It is obvious that the scientific knowledge acquired in the classroom need to be reinforced so as to apply them later in similar context. An effective teacher should recall the main points of the lesson, reward the correct responses and focus on the main areas. In order to respond and reinforce communication is a significant factor. When compared with the pre test score, 30% increase is observed in the post test on communication, which establishes the fact that the teacher trainees have enhanced their communication skill. In other words the teacher trainees have improved their skill in clarity, emphasizing key ideas, pronunciation, using non-verbal communication etc., Equal progress in planning and knowledge of the subject matter has been achieved in the post test.
i.e. 29% improvement. For presenting the knowledge of subject matter, a systematic planning is necessary. The enhancement in the post-test score reveals the development of the skill in planning and knowledge of the subject matter. In classroom management, the teacher trainee’s competence has increased from 48% to 76%. The enhancement proves that the teacher trainees have gained the competence in classroom management, which is very essential in the teaching of science subject. The post-test score on the competence, set induction reveals an improvement of 27%, which means that the teacher trainees have enhanced their competence in using previous knowledge, relevant statement, arousing intellectual curiosity and eliciting responses through questions. Using these components of set induction is a significant competence a teacher of science should develop. The outcome of the experiments reveals that the enhancement in set induction skill is achieved (21%). 26% improvement is observed in the post test on motivation and questioning strategies. It proves that the teacher trainees have improved their competence in these two skills. In using audio-visual support and in situational evaluation there is a substantial improvement in the post test (25%). The teacher trainees have also developed their competence in instructional techniques. The post-test score (77%) reflects a notable improvement (21%), when compared with the pretest.

The statistical outcome reveals that the cognitive intervention strategy i.e rehearsal has recorded an improvement in competence in the post test (30%). This strategy has played the most significant role in enhancing the competence of the teacher trainees. This strategy is closely followed by spatial learning which
has been improved in the post-test (72%). The enhancement of 28% is achieved in the competence of the teacher trainees in adopting this intervention strategy. In the post test on implementing the cognitive intervention strategy, “chunking” the teacher trainees have gained 26% improvement. The mental picture created by the science teacher facilitates rehearsal, spatial learning and chunking. The mental picture includes concept mapping, metaphor and imagery. The same percentage of enhancement (25%) is observed in the post-test on adopting these three cognitive intervention strategies. 24% enhancement is recorded in the post-test on advance organizer and 22% enhancement on mnemonics in the post-tests. When compared to the other cognitive intervention strategies, in advance organizer and mnemonics the teacher trainees have recorded less percentage of enhancement in competence due to the practical difficulties in the classroom situation in teaching science.

The adoption of the cognitive intervention strategy, rehearsal may have resulted in the enhancement of the competence on responding behaviour. The components of rehearsal namely questioning, retaining and note taking have contributed to the responding behaviour. Spatial learning cognitive intervention strategy would have contributed to the competence in reinforcement because comprehension of the relationship between concepts, relating prior knowledge with new knowledge, comparing and contrasting and brainstorming strategies strengthens the competence in reinforcement. Grouping, associating, structuring and sequencing strategies contribute to the competence in communication to a major extent. Concept mapping and imagery facilitate competence in planning
and knowledge of subject matter. Statistical evidence shows that creating a mental picture is one of the effective cognitive strategies for developing competence in the knowledge of the subject matter and planning. Advance organizer and mnemonics would have contributed to the enhancement of competencies such as set induction, motivation, questioning strategy, audio-visual support and situational evaluation. The assessment of the competence in teaching science with regard to different variables by teacher trainees themselves, peer group and the investigator in the progressive test reveal that the scores are almost similar.

The cognitive intervention strategy is very comprehensive which can be applied by a science teacher to develop the students learning process. The cognitive intervention strategy adopted by the investigator to improve the teacher trainees competence in teaching science had two-fold result i.e (i) the teacher trainees have enhanced their competence in teaching science and (ii) they have improved their competence to adopt cognitive intervention strategy. The strategy had made significant impact on various dimensions. It would be very difficult to isolate a particular strategy to identify its effect on any one dimension. The statistical data reveal a total enhancement in competence in the post-test. However, the investigator has observed through his experiment that the cognitive intervention strategy can develop different types of competencies of the teacher trainees, so that their performance in the classroom can be made achievement-oriented. A meticulous adoption of these strategies would doubtlessly develop competence in teaching science among DTE students.