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CHAPTER-VI

SUMMARY

6.1. INTRODUCTION

Today science and technology have become very sophisticated. Our powers of observation are aided by sophisticated gadgets. Mans vision is extended from very minute particles to the outer fringes of the universe by modern instruments.

For a science teacher it is essential that he first basically understands what is meant by science so that he can explain the concept of science to the students.

The linguistic origin of the word science, the English word science is derived from the Latin word ‘Scientia’ which simply means ‘knowledge’. Meaning of science is based on the German word ‘Wissenchaft’ which means systematic, organized knowledge’.

Campbell describes science as consisting of two forms; science is a body of useful and practical knowledge and a method of obtaining it. Science is a pure intellectual activity.

Weigner a physicist regards science as a store of knowledge of natural phenomena.
Einstein said “whole of science is nothing more than a refinement of everyday thinking”

Fisher (1975) presents a working definition of science as ‘science is the body of knowledge obtained by methods based on observation’.

Fitzpatrick (1960) defined science as a cumulative and endless series of empirical observations which result in the formulation of concepts and theories, with both concepts and theories being subject to modification in the light of further empirical observations.

6.2. AIMS OF TEACHING SCIENCE

Repeated criticism against teachers is that Science is presented as a group of unrelated facts. Hence the aims of science teaching with regard to developing and understanding the nature of science should be:

According to the national science teachers association (1961), as a result of science education, students should be able to think critically in solving problem situation in their life. Students should be helped to develop and enjoy science related interests. Kothari commission 1964-66 said about the development of power of observation. NPE 1986 stated science education programmes need to be designed so as to enable the learner to acquire the problem solving and decision making skills, to discover relationship between science and health, agriculture and industry, and other aspects of our life. NCERT 2001 suggested to acquire
skills, which form part of the attitude for developing scientific temper, understanding the process of sciences, and preservation of environment, inculcates values, understanding basic principles, understand nature of science. etc.

For a science teacher it is possible to achieve the aims of science education involves all types of experiences in the school, outside the school. The objectives of science teaching is building of scientific precision, scientific attitudes, and science process skills like measurement, observation etc.

Science is taught in secondary schools today because of the recognized need for general scientific literacy. Aims of physical science teaching according to Thurder and collite(1964) towards 1. understanding the nature of science, 2. meeting the goals of general education, 3. help young people to fit themselves into their society, 4. maintain physical health and well being, 5. helping people with personal adjustment, 6. giving students exploratory experiences., and 7. provide opportunities to develop vocational interests.

6.2.1. COMPETENCY BASED TEACHER EDUCATION

From the aspect of Passi and Sharma, 1981, the concept of teaching competency in India emerged from Competency Based Teacher Education (CBTE) programme. The education commission of India
provides for free and compulsory education for all children up to the age of 14 years. Children have to be moulded and guided for proper development about their talents and for that purpose the teacher possess the required competencies skills and the bent of mind. Competency means the right way of doing things. The Qualities of Competency are enthusiasm, fluency, industry, neatness, originality, adaptability and thrift. In teaching, the competency means the right way of conveying the units of knowledge, application, and skills to the students and the knowledge of contents, methods, and communication. Teacher education is the research based understanding of teachers competencies like contextual, conceptual, content, transactional, and evaluative and management competencies.

6.2.2. TEACHER EDUCATION

Role and functions of DIET: National policy on education, 1986 and its Programme of Action, 1992 emphasized the need for restructuring and strengthening of teacher education having several components. Accordingly a centrally sponsored scheme in each district was launched to improve the quality of teacher education. The establishment of District Institute of Education and Training (DIET) in the country is one of the most important components of the scheme. The mission of DIET is to provide support to elementary education, Non formal Education and Adult literacy.
The major functions of DIET are

a) To organize pre-service and In-Service teacher education for elementary school teachers.

b) To provide resource support (Extension/guidance, development of materials, aids, evaluation tools etc.).

c) To conduct action research.

DIET were visualized as vibrant institutions at the district level to provide academic and resource support at the grass root levels for the success of various strategies and programmes being undertaken in the areas of elementary and adult education. Quality of education has emerged as an important priority and DIETs have a critical role in this direction. Teacher education is a continuous process. Pre-service and In-service training of teachers therefore forms an important component of this process. The role of DIET can be broadly classified as transactional and transformational. The transactional role is that the DIET undertakes the training of headmasters and teachers at elementary state through Pre-service and In-service training. Transformational role is that the DIET has to act as an agent of change by introducing new ideas and methods through refresher courses for the grass root workers.
6.2.3. COMPETENCIES IN TEACHING SCIENCE

The General Competencies in Science Education are,

- The Teacher candidate understands the central concepts of science, tools of inquiry, and structures of the discipline and can create learning experiences that make science personally, vocationally and academically meaningful and relevant for students.

- Teacher candidate understands that children construct meaning and can provide learning opportunities that support their intellectual, social and personal development.

- The teacher candidate understands how students differ in their approaches to learning and creates instructional opportunities that are adapted to diverse student needs including: gender, cultural or ethnic background, disabilities, aspirations, or interest in science.

- The teacher candidate understands and uses a variety of instructional strategies to encourage students' development of critical thinking, problem solving, and performance skills and matches these strategies to content learning theory and student diversity.

- The Teacher candidate uses an understanding of individual and group motivation and behavior to create a safe, ethical, and legal learning environment that encourages positive social interaction, active engagement in learning, and self-motivation.
• The teacher candidate uses knowledge of effective verbal, nonverbal, and media communication technique to foster active inquiry, collaboration, and supportive interaction in the classroom.

• The teacher candidate plans instruction based upon knowledge of science and students in the context of the community, and curriculum goals.

• The teacher candidate understands and uses a variety of formal and informal authentic assessment strategies to evaluate and ensure the continuous intellectual, social and physical development of the learner and encourage student’s self assessment.

• The teacher candidates are a reflective practitioner who constantly analyses, evaluates, and strengthens their practice in order to improve the quality of their students learning experiences.

• The teacher candidate fosters, relationships with school colleagues, parents and agencies in the larger community to support individual students, learning needs and overall teaching practice.

• Accomplished science teachers create opportunities for students to integrate and coordinate the context of science with other subject areas.

• Science Teachers are aware of and act on a knowledge related to social, ethical and legal aspects of teaching.
6.3 NEED AND SIGNIFICANCE OF THE STUDY

The purpose of education in our schools is to provide experiences through which young people can acquire the knowledge, skills and attitudes that lead to patterns of behaviours acceptable to the democratic society. In the attainment of the above a science teacher has to work. The goals of science education are,

To create a functional understanding of the available generalization, in the body of science. It enables knowing and understanding among students.

To develop coping skills, which are essential for making justifiable actions in response to many problems they are to face in future life.

To develop manipulation skills, science education should help students to react rapidly.

Only a few students will become practicing scientists, but all of them will benefit by science. Hence they need to be informed about the intellectual and technological base of scientific knowledge. Science teaching is not a set of instructions that will help the pupil to pass in examination rather it should teach him to participate in the process that makes possible the establishment of knowledge. The roles of science teachers demand new skills and competencies in addition to the curriculum oriented roles. The science teacher is supposed to be the guide
of the community and he should know the new developments in the field of science and technology. The science teacher needs to equip them with skills and competencies to meet the challenges in teaching and learning process. The science teaching in its content and methodology needs renewal. The teacher trainees have to identify the requisite skills /competencies and strategies to teach effectively. The objective of science education is to equip all science teachers with such skills so that a complete transformation will be possible.

6.4. SCOPE OF THE STUDY

Student teachers need to know to self-regulate and monitor their own teaching and learning processes when teaching science. This study believes that metacognitive intervention and motivation intervention strategies helps student teachers to analyze and manage teaching and pursuit of knowledge acquisition in teaching science and gain insight and creativity in teaching.

If students' teachers are trained with modern effective approaches then number of school going children will be benefited. Therefore this study aims at to find metacognitive orientation on competency in teaching science. This helps student trainees to choose appropriate strategies and to regulate ones metacognitive process to the task. Development of Competency in teaching science will enhance the science teaching.
The national policy of education was designed by keeping in mind the achievements and failures of education till 1986, the recommendations for science education in the NPE are,

Science education should be strengthened so as to develop in the child well defined abilities and values such as the spirit of inquiry, creativity, objectivity, the courage to question and aesthetic sensibility.

Science education programmes need to be so designed so as to enable the learner to acquire problem solving, decision making skills and to discover relationship of science with health, agriculture, industry and other aspects of daily life. They also called for special efforts to extend science education to the vast members, who have remained outside the preview of formal education.

As proposed by the national policy of education (1986) there is urgent need to modify curricula and methodologies of learning through appropriate research.

6.5. STATEMENT OF THE PROBLEM

Researches support that the metacognition enhances the teaching competency and teachers can be motivated towards teaching learning process. This made the investigator to develop the metacognitive strategies to raise the level of metacognition. The student teachers motivation is enhanced using the motivation strategies. The
metacognition and motivation strategies in turn enhance the competency in teaching science. Hence the problem of the study was stated as "EFFECT OF METACOGNITION AND MOTIVATIONAL INTERVENTION STRATEGIES ON DEVELOPING COMPETENCIES IN TEACHING SCIENCE AMONG DIET TRAINEES".

6.5.1.DEFINITIONS OF KEY TERMS

Effect: According to Webster’s Dictionary’Effect’ means the power to bring about a result.

Metacognition: thinking about ones own cognitive processes

Motivation: Motivation leads individual towards a goal.

Motivation is an internal force or energy or need which initiates sustains, directs and regulates the behaviour of the learner.

Intervention: According to Oxford Dictionary intervention means “interference”

Strategy: a plan to achieve goal

Developing: improve

Competency: having necessary skills to do some thing successfully.

Teaching: show how to do things. provide information to learn

Science: body of knowledge of natural Phenomena
6.5.2 OPERATIONAL DEFINITIONS

Effect:

The effect refers to cause and effect of variables. The response created by the independent variable.

Metacognition:

Metacognition is the knowledge and awareness of one's own cognitive processes (Flavell 1976)

The ability to monitor, regulate and evaluate one's thinking (Brown 1978). "Metacognitive processes enable individuals to better control their thinking and thereby become more efficient and flexible learners"

The subjects are asked to monitor, regulate and evaluate their thinking; Learners are given training on the dimensions of metacognition to improve their learning skills.

Motivation:

Something which prompts, compels and energies an individual to act or behave in a particular manner at a particular time for attaining some specific goal or purpose.

The subjects are given motivation to do a task. Motivation is a process in which the learner's internal energies or needs are directed towards a goal.
Intervention

According to Oxford Dictionary intervention means “interference”.
The independent variables intervene a process of learning causing changes in the dependent variable. Metacognition and motivation strategies intervene the learning.

Strategy

The art of planning a skill in managing any affair.

Metacognition and motivation strategies are used.

Developing

Improving the teaching competency in science.

Competency

A set of elements which lead not only to develop a skill but a good combination of knowledge, understanding, problem solving abilities and values (attitudes).

Competency is equipping the teacher with adequate knowledge and ideas to begin with profession career.

Competency is the demonstration of knowledge, skills and attitudes required to perform a given task or act.
Competency is transformation of inborn/innate qualities and concealed/hidden strength of the individual into application (utility).

Teaching

Teaching process is determined by knowledge a set of abilities, attitudes, and skills which in turn determine pupil outcomes.

Teaching can be defined as a set of observable teacher behaviours that facilitate or bring about pupil learning.

Science

Science encyclopedia has emphasized, "Science is an accumulated and systematized learning in general usage restricted to natural phenomenon.

Science is a cumulative and endless series of empirical observations which result in the formation of concepts and theories with both concepts and theories being subject to modification in the light of further, empirical observations (Frederic, 1960).

Science is both a body of knowledge and the process of acquiring it.

6.6. OBJECTIVES OF THE STUDY

- To assess the level of competency in teaching science among the student teachers.
- To assess the level of metacognition among the student trainees.
- To assess the level of motivation among the student trainees.
- To identify the metacognitive strategies that enhances the competencies in teaching science among the student trainees.
• To identify the motivational strategies that enhances the competencies in teaching science among student trainees.
• To develop a model that contains metacognitive and motivational strategies and principles to enhance the competencies in teaching science among student trainees.
• To implement the model to the student teacher to enhance the competency in teaching science.
• To test the progress of science teaching by the student trainees
• To test the level of metacognition and motivation among the student teachers.
• To test the effect of metacognition and motivation strategies on enhancing the competencies in teaching science.
• To identify the effect of motivation intervention strategies on competency in teaching science among the student teachers.
• To identify the effect of metacognition intervention Strategies on competency in teaching science among the student teachers.

6.7. HYPOTHESES

The following are the hypotheses framed for this study

- There will be significant difference between the pretest and progressive test (I) scores on competency in teaching science among the student teachers.
• There will be significant difference between the posttest and progressive test scores on competency in teaching science among the student teachers.

• There will be significant difference between the pre and post test scores on competency in teaching science among the student teachers.

• There will be significant difference between pretest and progressive test on level of metacognition among the student teachers.

• There will be significant difference between progressive test and post assessment of the level of the metacognition among the student teachers.

• There will be significant difference between the pre test and post test of the level of the metacognition among the student teachers.

• There will be a significant difference between the pre assessment and the post assessment of motivation

6.8. ASSUMPTIONS

• Student teachers could be given training towards developing the competency in teaching science.

• Student teachers in DIET use metacognition and motivation strategies while teaching Science.
• Motivation level of students teachers is low
• The Level of motivation could be developed.
• There is significant correlation between motivation and competency in teaching science.
• The student teachers can design and develop strategies to motivate the students towards teaching of science.
• The student teachers can enhance the competency in teaching science by motivating them through activating motivational strategies.
• A model based on the metacognition and motivation principles enhance the competency in teaching science.
• An intervention with the help of the model should enhance the competency in teaching science.
• The progress of the learners would be assessed with the help of the tools, formulated by the researcher.
• After the intervention programme the final assessment of the competency in teaching science would be done.
• Effective use of competencies /skills increased after the treatment.

6.9. DELIMITATIONS OF THE STUDY

The investigator adopted single group experimental design. This design did not use any control group.
The investigator is confined to the second year D.T. Ed. DIET students whose age group is 17-20 years.

The investigation has been conducted in DIET Pondicherry.

The study has been conducted for three months.

6.10. EXPERIMENTAL DESIGN

The investigator has employed experimental design single group pre test-treatment- post test design.

The researcher selected this design due to the following reasons.

- Being a science teacher for this group of students, this group is readily available.
- The researcher liked to continue the research work without affecting regular academic work.
- The students have undergone observation study and teaching practice in the schools they can only be used for the experimentation.

The procedure in this design is as below

\[
\begin{align*}
O1 & \quad X & \quad O2 \\
\text{Pretest} & \quad \text{treatment} & \quad \text{post test}
\end{align*}
\]
In this study competency of teaching science is dependant variable. Metacognition and motivation are independent variables. All the three variables are assessed before treatment. During the treatment progressive assessment in competency in teaching science and metacognition are assessed. When the treatment is over post assessments in all the above three variables were competed.

6.10.1. ADVANTAGES OF THIS DESIGN

This type of design permits an experiment to be conducted by a teacher in his own classroom without assistance. Since the same group and same teacher were involved, it seems to make a fair attempt at equating the factors of the ability and background of the subjects and the general characteristics of the experimental situation. No part of the difference in the results can be attributed to the validity of the subjects or the teachers.

6.11. EXPERIMENTATION IN PHASES

PHASE-I

1. Understanding the need for a Training Model for trainees of DIET.

2. Developing a suitable training model to enhance motivation, Metacognition, Competency in teaching Science.
PHASE –II

3. Administering pretests in metacognition, motivation, and competency in teaching science.

PHASE III

4. Training was given to trainees using training model developed by the investigator, for three months.

5. Assessing the trainee’s performance progressively.

PHASE-IV

6. Administering post tests in motivation, metacognition, and competency in teaching science using the same tools.

PHASE –V

7. Entering, categorizing and analyzing the pretest and post test scores.

8. Interpreting the result of the experiment after analyzing the data.

6.11.1. VARIABLES

The present investigation is an attempt to determine the effectiveness of metacognition and motivation intervention strategies on Competencies in teaching science and to estimate the extent of relationship between the selected variables.

Metacognition is independent variable in this study.

Motivation is independent variable

The Competencies in teaching science is dependent variable.
6.11.2. SELECTION OF THE SAMPLE

The present investigation was carried out in DIET, Pondicherry, in the Union Territory of Pondicherry. Nearly 200 students are studying in DIET out of them 20 students who have opted to act as samples were taken for the research. All the students selected for the present study were studying in English medium. A single group design was developed.

6.11.3. CONSTRUCTION AND VALIDATION OF TOOLS

These tools are developed by the investigator except achievement motivation scale, and validated by the experts in the field of education.

The investigator on the basis of review of related studies and correlates on competency in teaching science identified that metacognition and motivation influences competency in teaching science. Hence the investigator decided to measure the effect of metacognition and motivation with their respective tools.

The investigator administered the scale to measure the competency in teaching science. The validated tools used are the following:

1. Metacognition assessment scale developed and validated by the Investigator.

2. Achievement motivation Scale (Beena Shah, 1986).
3. Competency in Teaching science developed by the Investigator.

To construct a tool, there are several factors to be kept in mind. The factors include the area, the age group, and the grade for which the test to be developed. The following are the important factors.

Planning

When constructing a tool the limitations under which it is to be developed should be considered. This includes the purpose of the tool, time, nature of the sample, cost and resources at the disposal of the researcher etc.

The preliminary draft should be prepared, it contains double the items needed and it should be edited. A small group try-out helps the researcher to get the indices of the difficulty and discrimination quickly for selecting good items for the final test.

Item analysis

The item analysis is important for the improvement of the total score reliability or total score validity or both. The final draft should be prepared and the selected items are included which will be administered to sample.
While constructing the tools the purpose of the tool, the language and the length of the tool should also be taken care of, considering the above facts the tools were constructed.

**Content validity**

Refers to the degree to which the test actually measures, or is specially related to, the traits for which it was designed. Content validity is based on careful examination of course text book, syllabi, objectives, and subject matter specialists, often assessed by panel of experts in the field who judges its adequacy.

**Reliability**

A test is reliable to the extent that it measures whatever it is measuring consistently. Reliable tests are stable in whatever they measure and yield comparable scores upon repeated administration. The reliability or stability of a test is usually expressed as a correlation coefficient. The reliability of the tools was established by KR 20 method. The reliability of the questionnaire of metacognition is 0.7 and the motivation is 0.33 the competency of teaching science is 0.65
6.12. SCHEME OF DATA ANALYSIS

- Pretest: MC, MOT, CTS
- Treatment: Progressive test
- Descriptive statistics (M, FAN & SD)
  - X11, X12, X13, X21, X22, Y11, Y12, Y13
- Relational Statistics
  - MC&MOT
  - MC&CTS
  - MOT&CTS
- Differential statistics
  - AMONG PRE, PRO, POST TESTS OF MC
  - AMONG PRE, POST TESTS OF MOT
  - AMONG PRE, PRO, POST TESTS OF CTS
- Regression analysis
  - X11, X12, X13, X21, X22
- Non parametric tests
  - Y11&Y12
  - Y11&Y13
  - Y12&Y13

In the present study, the relevant data obtained from the test scores of 20 students in the pretests and the posts tests has been analysed as follows.

6.12.1. DESCRIPTIVE ANALYSIS

This generates information about the nature of a particular group of individuals mean and standard deviation were calculated to determine the central tendencies and dispersion of variables.
6.12.2. RELATIONAL ANALYSIS

This analysis involves the measurement of strength of closeness of relationship between the variables. Karl Pearson co-efficient of correlation technique was used to determine the correlation between the pre test and post test.

6.12.3 DIFFERENTIAL ANALYSIS

In the differential analysis the researcher makes inferences involving determination of the statistically significance of difference between the pre test and post test scores with references to selected variables. Correlated 't' test, Wilcoxon signed rank test was used to analyse the significant difference between the pretest, progressive and post test scores.

The 't' test values were calculated to test the significant difference between the mean scores of the pretests and post tests of different variables. Here 't' test was used as both the pretest and post test mean belong to the same sample group.

Wilcoxon Signed Ranks Test

The Wilcoxon matched pairs signed ranks test is more powerful than the sign test. this test deals with dependant groups made up of matched pairs of individual and is not applicable to independent groups.
The Wilcoxon signed rank test is another substitute for the ‘t’ test in paired samples. It gives the information about the direction of the differences with in the pairs and also the relative magnitude as well as direction of the difference. In the Wilcoxon signed rank, the ranks are substituted for numbers. It provides a very alternative to the permutation test. It is exactly the permutation test based on ranks.

6.13. FINDINGS

- The competency in teaching science is enhanced in the progressive and post test.
- The level of metacognition of the student teachers is increased in the progressive and post tests than the pretest.
- The motivation level of the student teachers is enhanced in the post tests.
- Correlation analysis:
  - The ‘r’ value between post test of metacognition and competency in teaching Science Progressive test scores are significant.
  - The ‘r’ value between the metacognition post test and pretest are significant.
  - The ‘r’ value between motivation post test and pre test are significant.
• The ‘r’ value between the competency in teaching science post test, pre test, and progressive test are significant.

• The ‘r’ value between the metacognition post-test, pre-test, competency in teaching science progressive test are significant.

- The competency in teaching science is enhanced in the student teachers in the progressive test than pretest.

- The level of metacognition of student teachers is increased in the progressive test than the pretest.

- The level of metacognition of student teachers is increased in the post test than the pretest.

6.14. DISCUSSION

The competency in teaching science is enhanced during and after the treatment.

There is 8.2 % increase in mean scores of competency in teaching science from pre test to progressive test, and 28 % increase in the mean scores of pre test to post test.

The level of metacognition of the student teachers is increased. There is 9.5 % increase in the mean scores from pretest to progressive test and 21.1 % increase in the pretest to post test.
The level of motivation of the students teachers is increased. There is 5.5 % of increase in the mean scores from pretest to post test.

The 'F' value among the various tests of all the variables of competency in teaching science and metacognition, motivation reveals that there is significant difference among the various tests and assessments of all the three variables.

All the 't' values between the pretest, progressive test and post tests of competency in teaching science are significant at 0.05 level.

All the 't' values between the pretest, progressive and posttest assessments of metacognition are significant at .05 level. This shows increase in the level of metacognition of the students teachers from pretest to posttest.

All the 't' values between the pretest and post test of motivation are significant at .05 level. This shows the increase in the level of motivation in student teachers from pretest and posttest.

The values of standardized Beta co-efficient in the multiple regression of the Metacognition pre test and Motivation pretest. The Beta co-efficient of Motivation pre test is greater than the Beta co-efficient of Metacognition pre test. The Motivation Pre test enhances the
Competency in teaching science pretest when compared with metacognition pre test.

The values of Standardised Beta Co-efficient in the stepwise multiple regression shows that 13 percentage variation due to influence of metacognition pretest, motivation pretest, metacognition progressive test.

The metacognition progressive test and motivation pretest enhanced the competency in teaching science progressive test.

The values of Standardized Beta Co-efficient in the stepwise multiple regression shows that 44 percentage variation is due to the influence of independent variables. So the hypotheses is accepted.

The metacognition post test, motivation pretest and competency in teaching science pre test, enhanced the competency in teaching science post test.

Sum of Positive rank is very much different from sum of negative rank so it is inferred that there is difference between the pair of tests. when N is large sample than 25, the sum of the ranks is approximately normally distributed.

The calculated ‘Z’ scores is greater than the table value 1.96 at .05% we accept hypothesis then we conclude that there is significant
mean difference between pre, progressive and post test in Competency in teaching Science.

The findings were supported by similar findings of the studies in teaching competency carried out by Tamilmani. P. (1990), AL-Jassar, salva A. (1991), Das R.C., Passi B.K., Jangira N.K., Singth A., (1982).


6.15. CONSOLIDATION OF ANALYSIS

- The competency in teaching science is enhanced in the progressive and post test.
- The level of metacognition of the students' teacher is increased in the progressive and post tests than the pretest.
• The motivation level of the student teachers is enhanced in the post tests.
• There is a correlation between the scores of metacognition and motivation in all pre test, and post tests.
• The competency in teaching science is enhanced in the student teachers in the progressive test than pretest.
• The level of metacognition of student teachers is increased in the progressive test than the pretest.
• The level of metacognition of student teachers is increased in the post test than the pretest.

6.16. EDUCATIONAL IMPLICATIONS

Teaching science in classroom is becoming highly challenging, conducting experiments, and doing activities and projects need competencies.

The competency of a teacher is determined by many variables. The competency in teaching science is determined by various dimensions like knowledge, facilitating instruction, science processing, communication, decision making, using motivation, metacognition strategies. Practicing the competencies in pre-service teacher education is the urgent need to improve teaching competency of a science teacher.
The investigator suggests the following suggestions to improve the competency in teaching science.

1. Motivation techniques should be used throughout the teaching of lesson. The student teachers should be given training in motivation techniques.

2. Training in awareness of metacognition strategies is needed to practice in classroom by the student teachers.

3. Training in motivation strategies is needed to practice in classroom by the student teachers.

4. Training in science process, communication, decision making, and instruction competencies should be given to student teachers.

6.17. SUGGESTIONS FOR FURTHER RESEARCH

To overcome the limitations of the present study and to extend the scope of the research findings of this study, a few suggestions are given below for further research.

The present study was confined to the samples of student trainees of D. T. Ed. of DIET Pondicherry. It is suggested that the above study may be repeated with other DIET students.

The present investigation was carried out to find out the effectiveness of metacognition and motivation on Competencies in
teaching science. It could be replicated with other variables such as competency in teaching social science and mathematics, etc.

The present investigation did not use the control group for the study. Similar study can be conducted with parallel groups.

Separate study for boys and girls may be carried out with different age group.

The present study was conducted for three months. Same type of study may be carried out for a longer period of time.

6.18. CONCLUSION

The present investigation explored on the development of competencies in teaching science in relation to motivation and metacognitive strategies, and the study indicates significant relationship among the variables.

The highest Beta value of motivation in pre-test in stepwise multiple regression for predicting competencies in teaching science pre-test shows the maximum contribution to competency in teaching science in the pre-test.

The highest Beta value of metacognition in progressive test in stepwise multiple regression for predicting competency in teaching
science in progressive test shows the maximum contribution to competency in teaching science in the progressive test.

Stepwise multiple regression for predicting competency in teaching science in post-test shows 44% variation due to the independent variables.

The multiple regression analysis reveals the predictive efficiency of metacognitive intervention strategy and motivation intervention strategy in enhancing the competencies in teaching science. From the analysis it is found that, due to the orientation of metacognitive intervention strategies and motivation intervention strategies the scores on competency in teaching science is increased from 55.7% to 63.9% in the progressive test and 83.7% in the post test. Further there was also a corresponding increase in the metacognition intervention strategies from 69.2% to 78.7% in the progressive tests, and 90.3% in the post test. In the motivation intervention strategies there was also an increase from 77.9% to 83.45% in the pre test to post test. Hence it is concluded that orientation in metacognition intervention strategies and motivation intervention strategies enhanced both the level of competency in teaching science and also the level of proficiency in metacognition and motivation intervention strategies.
The study reveals that orientation and training on dimensions of metacognition and motivation strategies in science will certainly improve the competency in teaching science. So it is recommended that in-service and pre-service training should have the core components of metacognition and motivation intervention strategies to train the student teachers and teachers to enhance their competency in teaching science.