Chapter I
CHAPTER I
THE PROBLEM

1.0 Introduction

1.1 Science Education for Thinking and Problem Solving

1.2 Envisaged Role of Science Teachers

1.3 Content Knowledge and its Relevance for Science Teaching

1.4 Significance of Problem Solving in Science Classrooms

1.5 Content Knowledge and Problem Solving

1.6 Teaching Aptitude and Teacher Effectiveness

1.7 Teacher Education
   1.7.1 Need and Significance of Teacher Education
   1.7.2 Revamping Teacher Education for Quality Improvement

1.8 Need for Investigation

1.9 Research Questions

1.10 The Topic and Definitions of the Terms
   1.10.1 Statement of the Problem
   1.10.2 Operational Definitions of the Terms
CHAPTER I

THE PROBLEM

1.0 Introduction

"Human mind is a unique gift, you can try to fathom the marvels of the universe. You can enter into it only if you have curiosity and thinking. I suggest to all of you, thinking should become your capital asset, no matter whatever ups and downs you come across in your life. Thinking is progress" (Kalam, 2002, p.15).

Lord Rutherford, the great pioneer of Nuclear Physics once said, “There is no substitute for hard and serious thinking; and hence instead of using your brain for memorizing information, it should be used for solving problems, creative thinking – the skill attributes of knowledge workers. Therefore any system of education, unless it is learner centred, is flexible, is around thinking skills and is able to help learners in acquiring the ability of learning how to learn, will gradually lose its relevance” (Maheswari, 2001, p.26)

At the back of all intellectual developments is the quality of thinking mind with the capacity to dive into unfathomable depths of knowledge exploration. An agile young mind has the facility to solve a complex set of problems but that mind must be broadened if it is to make effective use of that solution to meet human needs. There is little doubt of the relationship between our ability to think creatively and our capacity to be productive as individual members of the society.
1.1 Science Education for Thinking and Problem Solving

Teaching of science can justify its place in the curriculum only when it gives emphasis on important changes in young pupils, change in their ways of thinking, in their habits of action and in the values they assign to what they have and what they do. Indian Education Commission (1964-66) rightly observes “science has added a new dimension to education and its role in the life of a nation, but central to all this, is the quality of education. If science is poorly taught and badly learnt, it is very little more than burdening the mind with dead information and it could degenerate even into a new superstition. What we desperately need is the improvement in the standard and quality of science education” (p.390). Science education programmes should enable the learner to acquire problem solving and decision making skills and to discover the relationship of science with different aspects of daily life (NPE, 1986). National Science Education Standards (NSES) developed by National Research Council (NRC, 1996) also stresses the need for the development of understanding of science content through inquiry. National Curriculum Framework for School Education developed by NCERT (2000) contends that learning of science in school should augment the spirit of inquiry, creativity and objectivity along with aesthetic sensibility. However the realization of these skills depends upon the way science is taught in our schools.

In this connection, Indian Education Commission (1964-66) recommends that the quality of science teaching is to be developed considerably so as to achieve its proper objectives and purposes, namely, to promote an understanding
of basic principles, to develop problem solving, analytical skills and the ability to apply them to the problems of material environments and social living and to promote the spirit of enquiry and experimentation. Science strengthens commitments of man to free inquiry and search for truth as its highest duty and obligation. By its emphasis on reason and free inquiry, it even helps to lessen ideological tensions.

Project 2061: Science for All Americans (AAAS, 1989) which lays out some principles for effective teaching and learning, pointed out that science teaching related to scientific literacy needs to be consistent with the spirit and character of scientific inquiry and with scientific values. Students must be engaged actively in the use of hypotheses, the collection and use of evidence and the design of investigations and processes and placing a premium on the students’ curiosity and creativity.

Science education indeed provides immense personal satisfaction in having learnt some thing new, having explored the unknown and having applied the learning to useful effects. It leads to the application of problem solving methods and nurtures the creative and inventive faculties of every individual. In scientific inquiry, a problem is identified, pertinent data is gathered, hypothesis is formulated, experiments are performed, the results are interpreted and conclusions are drawn. “If Problem solving skills are properly cultivated through the teaching of science, the student can apply this skill to solve problems in his personal and social life” (Rao, 1997. p.5).
Problem solving has been used in science education for many years mainly as a tool which enables teachers to evaluate student’s ability to transfer concepts and understanding from the class room to the real life situations. When he solves the problems by himself, teaching and learning are said to be effective.

1.2 Envisaged Role of Science Teachers

Everyone accepts that the key component of an education system is teacher and his/her intellectual excellence is the major contributory factor in the quality of teaching. Competent teachers empowered to make principal judgements and decisions on their student’s behalf who possess broad and deep understanding of the subjects they teach, the nature of learning and schooling and the world around them and who exemplify the critical thinking, they strive to develop problem solving skills in students. When knowledge is blended with ‘skills’, the journey of excellence begins. No matter what his professional qualifications are, a science teacher has to be an investigator, curriculum developer, designer of activities and a researcher (Rajput, 1993). At the secondary stage, he could not only develop students’ interest in utility aspects of science, but also help them nurture their creative, analytical and application skills to the fullest extent possible.

Science teacher’s role is multidimensional in addition to the traditional role as an imparter of knowledge. Instead of transmitting content knowledge in a rigid manner, the emphasis in teaching will be on designing situations and variety of activities which enable students to learn actively. In this respect, the
teacher needs to investigate what the students already know, identify possible misconceptions and then design an appropriate educational setting.

A shift towards the teaching of inquiry skills which is definitely more complex than the traditional training of practical skills is needed. While presenting a problem and encouraging the students to find solutions, the teacher should help the students to recall all the relevant concepts and principles. They should be helped to apply these concepts and principles in the solution of the problem.

The thrust of learning will have to be now on developing in children the ability to think and make them good problem solvers and creative thinkers. The teacher has to believe "all students can think, not just the gifted ones. Let the students know that thinking is a goal. Create the right climate and model it" (Alvino, 1990. p.40). And hence, the teacher’s role also will shift from that of a person who controls learning in children by pouring information into their brains to that of a person who facilitates their learning by making them think (Maheswari, 2000).

Science teachers can play a significant role in the establishment of structure and net works in meaningful learning in students. In fact there are strong recommendations that teacher should carefully train students in purposeful strategic studying, reading and problem solving (Hydes and Bizar, 1989; Ganz and Ganz, 1990; Feden, 1994; Lucangeli, et.al, 1995; Willen and Philips, 1995; Gourgey, 1998). Teachers probably need to take sometime to teach strategies for thinking (Fogarty and Mc Tighe, 1993).
A significant factor in a teacher’s role is to help children accept the challenge to build a classroom where they want to solve problems. If appropriate strategies are employed, teachers can make learners better users of their metacognitive skills (Dixon Krauss, 1996). Teachers through careful student training, can invite students to be purposefully thoughtful. (Fogarty and Mc Tighe, 1993).

With proper instruction, human thought processes could become more spontaneously generated, more precisely focused and more insightfully divergent. Such refinement requires concentration, reflection and coaching. “Teachers of science must provide their students with inquiries that mentally and physically engage their students with the content and evidence. It may facilitate students’ understanding as well as provide opportunity for students to apply and transfer their knowledge to new situation” (National Research Council, 1999).

1.3 Content Knowledge and its Relevance for Science Teaching

Content knowledge or mastery in subject content refers to a teacher’s comprehension of a subject. According to Shulman (1986), teaching subject matter knowledge means the ways of representing and formulating the subject that makes it comprehensible to others.

Knowledge of subject matter has a sufficient impact on how teachers organize instruction. The soul of effective teaching is the command of subject matter. The teacher who knows core concepts, skills and attitudes will have the skill of conveying it in an effective manner. Research studies show that teacher’s
knowledge of subject matter influences teacher success (Brophy, 1991; Ebert, 1994; Khourey Bowers, 1995). Subject matter knowledge even contributes to the level of confidence in teaching (Tharyani, 1986). Lee (1995) contends that teachers with strong content backgrounds and skills in relating subject matter to the students tend to conduct classroom activities and discussions in a free-ranging way that facilitates learning.

Research evidence shows that a high percentage of teachers who are certified are not fully qualified in terms of content background (Shugart and Hounshell, 1995). Other research findings indicate that weak content knowledge increases teacher’s reliance on text books (Stoddart, et. al 1994; Claremont, et. al. 1994; Lee, 1995). A teacher’s weak content knowledge may not only influence how a subject is taught, but also what is taught. Ball and Mc Diarmid (1989) and Mc Namara (1991) contend that teachers with limited knowledge may avoid teaching certain subjects, fail to challenge misconceptions and discourage student interaction. They often avoid class discussions or other teaching situations that would expose their limited knowledge. Smith (1989) reported that the mastery orientation given to teaching science was found to have a strong relationship to her ability to implement planned conceptual change lessons. The significant gain in science content knowledge, self efficacy and constructivist practice indicated the value of designing an intervention programme which enhance the multiple components of effective teaching (Khourey-Bowers, 1995).
Content courses that provide opportunities to the teacher trainees for inquiry, critical thinking and identification of researchable questions at an appropriate level should form a part of teacher training programme. And hence the teacher training experiences should include programmes to improve content knowledge and teacher trainees should be engaged in in-depth investigations, collaborative work and reflections.

1.4 Significance of Problem Solving in Science Classrooms

Fostering problem solving ability in students is a frequently cited goal of science education. National Science Teacher’s Association (NSTA) in its Position Statement (1980) advocates that science teachers help students learn and think logically specifying that “…high school laboratory and field activities should emphasize not only the acquisition of knowledge, but also problem solving and decision making” (1985: p.48). Problem solving for some includes an attitude or predisposition toward inquiry as well as actual process by which individuals attempt to gain knowledge. Usually when teachers discuss problem solving on the part of the pupils, they anticipate pupils to be involved with thinking operations of analysis, synthesis and evaluation which are considered as higher order thinking skills. Problem solving skill is cited as one of the preliminary abilities of scientifically literate individual by the National Teacher’s Association Committee on Curriculum Studies in 1971 (Alan, 1980).

Problem solving strategies engage students regularly and effectively in scientific inquiry and facilitate the understanding of scientific knowledge. These inquiry techniques skillfully facilitate i) questioning and formulating solvable
problems ii) reflecting on and constructing knowledge from the data
iii) collaborating and exchanging information while seeking solutions and
iv) developing concepts and relationships from the empirical experience (Inquiry

Good problem solvers become aware of what they are doing and
frequently monitor or self assess their progress or adjust their strategies as they
encounter and solve problems (Bransford, et. al. 1999). Such reflective skills are
much more likely to be developed in a classroom environment especially science
classes that support them.

Moreover, scientific method of problem solving stimulates the individual
to consider the conditions of his problem carefully, to select his data accurately
and objectively, to evaluate his procedure critically and to test his conclusions
scrupulously. Good problem solvers have reflective mode of thinking which
aims at solving complex rather than simple problems. It requires reorganization
of all the relevant experiences and finding new ways of reacting to a new
situation. It takes all the relevant facts into account arranged in a logical order in
order to arrive at a solution of the problem at hand.

Michael and Chiapetta (1980) reported that a problem solving approach is
useful in improving the overall achievement of the students. It is especially
effective in facilitating the application of science subject matter to novel
situations. It will increase test performance at the knowledge, comprehension,
application and analysis levels.
The advantages of problem solving can be briefly summarised as follows–

- Problem solving helps the students to develop reflective thinking. Thus it will increase the students’ intellectual potency.

- This method helps students to approach future problems with confidence in their abilities to seek out the solutions, patterns and relationships.

Problem solving helps students to develop the ability to sense the relevance of the variables, make intuitive guesses and define problems concisely.

It builds a mental attitude for effective learning based on critical thinking.

- Students develop many skills while identifying the problem, conducting the experiment, recording observations, drawing conclusions and applying these generalisations to daily life situations.

Hence apprenticeship in analysis, problem solving and reasoning through regular lessons of curriculum become essential in science classrooms for the smooth running of an individual’s future life.

1.5 Content Knowledge and Problem Solving

Bransford, et. al. (1990) stressed the importance of specific content knowledge for thinking and problem solving. The factual knowledge attained through presentations, demonstrations and discussions provide an adequate base for the children to develop procedural knowledge through discovery and problem solving.
Research in science education indicates that the teachers who possess subject matter expertise and ability to transform the subject matter to their students in ways that students can understand and appreciate, facilitate discussions of content, reasoning and problem solving (Roth, Anderson and Smith, 1986). Mastery in subject content seems to enhance the problem solving ability of the students. Berquist (1993) revealed chemistry content knowledge of university level chemistry students as a significant factor on student performance in problem solving ability. Adequate organization of knowledge in memory increases the availability of knowledge. In other words, a suitable cognitive structure with content background plays a significant role in problem solving.

1.6 Teaching Aptitude and Teacher Effectiveness

NCERT publication entitled “Tools for B.Ed Admission” has stressed the importance of selecting the right type of teachers on some suitable criteria. The teacher trainees should be tested for their aptitude for teaching, teaching attitude, intelligence and general mental ability. National Commission on Teachers (1983-85) appointed by Government of India, also has stressed the importance of selecting right type of teachers on some reliable criteria as it stated, “in the absence of reliable tests of general ability and aptitude for teaching, in most places there is a tendency to go primarily by the qualifications of the candidates as recorded in certificates” (Aggarwal, 1995, p.235).

Research studies have indicated that teaching aptitude is a powerful determinant of effective teaching (Mutha, 1980; Bhasin, 1988; Shah, 1991).
Research evidences showed a significant positive correlation between teaching success and teaching aptitude (Kukretti, 1992; Jain, 1992).

Persons with high aptitude for teaching should be spotted out through testing and advised to join teaching profession. A procedure for interviewing the prospective teacher candidates has come in vogue. This interview does not help the interviewers to get the complete idea of the candidate’s knowledge of his subjects to be taught, his personality including sincerity, and above all his potential ability to teach and thereby wrong type of persons are recruited.

1.7 Teacher Education

No amount of investment in improving the physical and educational facilities can improve education unless there are adequate number of well qualified teachers who can willingly implement the educational process in such a way that it brings about the desired educational development of the students. It is therefore important that teacher is well prepared to do his/her work efficiently and effectively. The quality of teacher depends to a large extent on the quality of teacher education received by him/her (Quality Concerns in Teacher Education, NCTE document, 1998).

The objectives of teacher education have been to develop professional competencies among teachers by helping them to develop competencies and skills needed for becoming effective teachers. It enables teachers to foster creative thinking among pupils for reconstruction of knowledge and develop problem solving ability among pupils. The teacher training programmes also empower them to cultivate rational thinking and scientific temper among

1.7.1 Need and Significance of Teacher Education

In the current competitive global setting, teachers must symbolise intellectual leadership and should be ‘role models’ fully equipped to ignite the thirst for knowledge. A sound programme of teacher education is vital to maintain a high level of professional efficiency by upgrading the subject competency and teaching skills which are specially effective in bringing about the desired changes in the pupils.

A competent teacher has to master several teaching skills through a system of rigorous student teaching during teaching practice. With the introduction of audiovisual aids and similar gadgets in the classroom, the student teachers acquire necessary skills and competencies to handle such equipments which become imperative in good teaching. Use of educational technology in teaching learning process broadens the horizons of learning and enriches the learning experience of the students. Teacher education programmes may lead to guided practice in an intellectual engagement and results in visible transmission of knowledge with skills.

Research studies indicate that effective use of teachings skills in the classroom enhance academic achievement and retention of the subject matter among the learners (Singh, 1989). Morrison, (1966) and Tamil Mani (1990) also reported that teaching competency of science teachers is related to the academic
achievement of the learners. Effective teaching influences the performance of the students in individual subjects (Morrison, 1966). There are ample empirical evidences to show that the effective use of teaching skills in the classroom enhances teacher effectiveness (More, 1988; Prakasam, 1988). To be a competent teacher the teacher trainee has to apply the teaching skills during practice teaching and integrate all the teaching skills in an effective manner. This is possible through effective teacher training programmes which will help them to sharpen their teaching skills.

The training given in the colleges of education imparts self-confidence in student teacher to unlock his/her talents and remedy his shortcomings. He/she develops diversity in teaching methods with liberal use of teaching aids, case studies and projects. Teacher training programmes also provide opportunities for teacher trainees to develop the spirit of inquiry to enhance their problem solving skills. The teachers with rational thinking and scientific temper help their students to apply their acquired knowledge to life situations.

1.7.2 Revamping Teacher Education for Quality Improvement

The International Commission on Education appointed by UNESCO (1993-1996) for twenty first century observes, "rethinking of teacher education is necessary, in order to bring out in future teachers precisely those human and intellectual qualities that will facilitate a fresh approach to teaching" (p.146). This statement of the commission seems to be quite relevant for teacher education in India too. To enhance the quality of education, it is imperative to recruit motivated candidates for the profession.
The Indian Education Commission (1964-66) was of the opinion that “The essence of teacher education programme is ‘quality’ and in its absence teacher education becomes a financial waste and a source of over all deterioration in educational standards. Existing programmes of teacher education are largely rigid and divorced from the qualities of the schools and hence reorganization is needed at all levels” (p.67). According to National Policy on Education (1986), “teacher education programme lacks both academic rigour and professionalism. In the present context of knowledge intensive and information driven society, it becomes even more important for teachers to become facilitators of learning in diverse learning situations”. In this context, it is necessary to provide a substantially stronger academic foundation as well as a rigorous professional training for teacher trainees.

The NPE Review Committee (1990) has analysed the existing teacher training programmes and contends that the present teacher education programmes are theory oriented; practice teaching component is inadequate; and hence there is little scope for the development of qualities like empathy, right aptitude towards profession, children and society. The Yashpal Committee (1993) also noted that inadequate programme of teacher preparation led to the unsatisfactory quality of learning in the school and recommended specialized B.Ed programme or 4 years integrated teacher education programme specialized in secondary education.
The recommendations of different commissions mentioned above emphasize the need for revamping the teacher education programmes. The need for quality should be emphasized throughout the training programme. The science programmes of school education need special care and support which may be attained through a reorganized preservice professional training of science teacher trainees.

According to National Science Teacher’s Association (1998), preservice programme must emphasize extensive field experiences that allow future teachers of science to observe master teachers of science, effective use and model pedagogical practices with up to date relevant science content. The programme should also contain a long-term student teaching experience with a master teacher who models a standard based approach and understands:

- how to promote learning with understanding
- how to use students’ pre-existing knowledge and beliefs in designing science lessons that cause students to construct new knowledge.
- how to help students learn to recognize when they understand and when they need more information. The emphasis should be when the students are active rather than passive learners (NSTA, 1998).

1.8 Need for Investigation

Quality of education in higher education at present is one of the major concerns of the educationists of our country. The International Commission on Education for the Twenty First Century appointed by UNESCO (1993-1996) also insists on the quality while recruiting future teachers as it contends,
“improving the quality and motivation of teachers must be a priority in all countries” (p.147). Since teachers are central to improvement in quality and professional development is viewed as most crucial area of concern, improvement in the quality of teaching is to be considered of prime importance among other factors that affect the quality of education.

Good teaching is the mainspring of the nation’s economic and social progress resulting in enriching human life. Tremendous is the influence of good teaching on national development and so little is the attention paid to improve it by selecting the right type of candidates with genuine interest, aptitude and commitment to the teaching profession. It is therefore essential, that teaching at higher levels of education especially teacher training in India is to be improved whatever be the existing limitations.

In the first half of 20th century, emphasis in school education was on the acquisition of 3 Rs namely Reading, Writing and Arithmetic with little attention to transfer or problem solving. In the present century, fostering problem solving ability in students is acknowledged to be an appropriate objective for teaching science. However adoption of problem solving activities in school science course is happening very slowly. This is probably because the teachers themselves are not well versed in problem solving skills.

Efforts are already on the way in the developed countries like USA and other nations by establishing National Science Education Standards (NRC, 1996) to bring about a substantive change in science curriculum and teacher
preparation programmes (NSTA, 1998). In India very little effort is being taken in this direction. Though in India, National Curriculum Framework for School Education developed by NCERT (2000) responds to new societal and pedagogical changes which are within the broad parameters of the NPE – (1986 revised in 1992) insists on the development of inquiry skills in the science classrooms, radical reforms in the curriculum is yet to be done. The present school curriculum especially the science curriculum does not yield much scope for the development of problem solving skills among the students. This is possible, only if the teachers who teach science are equipped with scientific attitude, scientific literacy, scientific habit of mind, problem solving ability and scientific inquiry. Therefore teacher training programmes especially in science education, should provide opportunities for teacher trainees to develop the spirit of inquiry to enhance their problem solving skills and to deal sensibly with daily life problems. Such trainees after completing the training programme, will be competent enough to meet the requirements and objectives of science education provided in the school curriculum.

Teachers with a rich knowledge base offer more to their students than less informed teachers. Knowledge of subject matter has a significant impact on how teachers organize instruction. Indian Education commission (1964-66) also reaffirms the importance of subject matter knowledge in teacher training programmes when it states, “There should be a provision in teacher training programme for a study of the subjects to be taught in depth as well as in range” (p.72). Thus a teacher in an information age warrants to be equipped with
ndepth knowledge and modern competencies to work efficiently to cater to the
needs of the students. However review of literature reveal very little research is
being done in India to assess the relationship of subject matter knowledge to
teaching competency. The present study would explore the relative importance
of content knowledge in enhancing teaching competency.

Therefore it should be ensured that the students selected for teacher
training programme have adequate content base in their respective areas of
specialization. In some states such as Andhra Pradesh and Tamil Nadu,
admissions to teacher education programmes are based on the performance of
the candidates in a Common Entrance Test which tests the content knowledge of
the teacher trainees as well as their teaching aptitude. But in Kerala the student
teachers are not tested on the content knowledge while admitting them to teacher
education courses. Selection for B.Ed admission is based on their university
examination marks and not on the basis of entrance examination or aptitude
test scores.

Though there is ample scope for selecting right personnel to teaching
profession little or no care is taken to select candidates with an aptitude for
teaching. To enhance the quality of education, it is imperative to select proper
persons for profession. Before admitting the students to teacher education
programmes, there should be a provision to assess the basic skills, traits and
abilities which are prerequisite for successful performance in teaching
profession. It is necessary to evolve an admission procedure that make it feasible
to predict whether the selected candidates are trainable and how successfully
they will perform as teachers. In many states, the prospective candidates are interviewed before they are admitted to the course. However Passi (1994) reported that the predictive validity of such admission procedure is doubtful. In this context, the National Council for Teacher Education (NCTE), the statutory body for ensuring the quality of teacher education has asked the higher education department to examine the possibilities of introducing a Common Entrance Test (CET) for teacher education courses. More (1988) also recommended an improved criteria for admission to teacher education programme.

Many researchers have reported teaching aptitude as a powerful determinant of effective teaching (Mutha, 1980; Bhasin, 1988; Shah, 1991; Kukretti, 1992; Jain, 1992). Hence there is an urgent need for the right selection of teacher trainees for B.Ed training programme. The graduates and post-graduates with high aptitude for teaching should be spotted out through aptitude testing and admitted to the teacher training programmes.

The main focus of teacher education programmes is to plan and provide programmes and experiences that could enhance teaching competency of the teacher trainees. Such programmes include microteaching practice, practice teaching, preparation and use of teaching aids, use of educational technology etc. How efficiently those programmes contribute towards teaching competency is a matter of great concern for teacher educators. It is a felt need to assess the teaching competency of the teacher trainees and identify the skills that could enhance the teaching competency. This will help in revamping and refocusing the teacher education programme so as to produce competent teachers.
Furthermore, since there is not adequate research evidence assessing the relationship among content knowledge, problem solving ability, teaching aptitude and teaching competency, it is thought necessary and apt to explore interrelationship among these variables. The findings of this study may help in formulating an appropriate criteria and evolving a procedure for selecting prospective candidates to teacher education programme. Under these circumstances this study “Problem Solving Ability, Aptitude and Competency in Teaching Science of Trainees in Colleges of Education in Kerala” is undertaken.

1.9 Research Questions

The present study seeks to answer the following research questions.

1. Do subject matter knowledge of high school Biology and problem solving ability of student teachers have any impact on their teaching competency?

2. How far the trainees in the colleges of education succeed in applying the relevant subject matter knowledge of high school Biology in solving problems?

3. Is it possible to predict the science teacher trainee’s teaching competency in terms of their subject competency, problem solving ability, aptitude for teaching and performance in science at degree level?

4. How effective are the personal variables and variables such as mastery in subject content of high school Biology, problem solving ability, teaching aptitude and performance in science at degree level in predicting the teaching competency of science teacher trainees?
5. Which of the selected variables effectively discriminate between high competent and low competent teacher trainees?

6. Do science teacher trainees differ in their mastery in subject content of high school Biology, problem solving ability, teaching aptitude, performance in science at degree level and teaching competency owing to differences in a) gender b) region c) qualification of the teacher trainees d) college management type e) education of father f) education of mother and g) occupation of father h) occupation of mother and i) parental income?

1.10. The Topic and Definitions of the Terms

1.10.1 Statement of the Problem

The problem is “Problem Solving Ability, Aptitude and Competency in teaching Science of Trainees in Colleges of Education in Kerala”.

1.10.2 Operational Definitions of the Terms

The operational definitions of the important terms used in the present study are given below.

1) Problem Solving Ability in Science

Problem solving ability in science refers to an inquiry approach that involves the use of scientific method and advanced inquiry in solving carefully selected and designed problems. Students play an active role in determining and seeking the critical information needed to solve the problem.

In the present study, it refers to the score obtained by the science teacher trainees in the colleges of education (Natural Science Optional) in the ‘Problem Solving Ability Test’ prepared by the investigator.
b)  **Mastery in Subject Content of High School Biology**

Mastery in subject content refers to teachers’ comprehension of key facts, concepts, principles and explanatory framework within the discipline.

In the present study, mastery in subject content refers to the score obtained by the trainees in the colleges of education (Natural Science Optional) in the Test of ‘Mastery in Subject Content of High School Biology’ prepared by the investigator.

c)  **Teaching Aptitude**

Teaching aptitude refers to the traits and abilities that constitute to success in teaching. A person with teaching aptitude is one who has good proportion of traits and abilities required for becoming successful teachers. The magnitude of these traits may differ from individual to individual.

In the present investigation, teaching aptitude refers to the score obtained by the trainees in the colleges of education (Natural Science Optional) in the Teaching Aptitude Test Battery (TATB) prepared and standardized by Karim and Dixit (1986).

d)  **Performance in Science at Degree Level**

In the present study performance in science refers to the knowledge attained or skills developed in the science subjects taken at the degree level of students because B.A/B.Sc is the minimum qualification for entry into the B.Ed degree course.
Marks scored in science subjects in the B.Sc examination conducted by the university as recorded in the college register is taken as the performance in science score.

e) Teaching Competency

Teaching competency refers to an individual’s demonstrated knowledge, skills or abilities (KSAs) performed in a specific standard while teaching. Applied to teachers, competency means the right way of conveying units of knowledge, application and skills to students.

In the present study, teaching competency is defined as those attributes of knowledge, intellectual skills and abilities that the trainees in the colleges of education (Natural Science Optional) should possess during their teaching practice classes, as measured by an adapted version of General Teaching Competency Scale (GTCS) prepared and standardized by Passi and Lalitha (1979). It refers to the score obtained by the teacher trainees for their competency in teaching.

f) Trainees in the Colleges of Education

Trainees in the colleges of education denote the entire population of students enrolled for the B.Ed degree course (Bachelor of Education) in the colleges of education of different Universities of Kerala who are qualified for admission after three year degree course (B.A/B.Sc). In the present study, they constitute the population of preservice natural science student teachers in the colleges of education from Kerala.
Other Variables Included in the Study

Other variables include gender, region, qualification of the teacher trainees, college management type, education of father, education of mother, occupation of father, occupation of mother, and parental income.