CHAPTER I

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INTRODUCTION

*Education is meant to bring out the best in man, to develop his potentialities to the maximum, to integrate him with himself, his surroundings, his society, his country and humanity to make him the ‘complete man’, the ‘integral man’.*

-Sri Aurobindo (1907, *A System of National Education*)

The purpose of education cannot be merely for creating a literate individual, or a highly informed person crammed with information and facts, or to create an individual to find a job. The more important aspects of an individual are his character, his personality and his values. According to him, the process of education must be integral aiming at the total and complete development of the individual: a strong, supple, well formed and healthy body; a sensitive, unselfish and mature emotional nature; a positively energetic vital, an enlightened mind, a wide ranging and vibrant intelligence, a strong will, a balanced and pleasing personality; and the subtler spiritual qualities that can channelize, harmonize and direct all the different parts of an individual into a life that is beneficial to the individual and to his fellow men. In short, Sri Aurobindo says that education should be integral, so that it develops the physical, mental, vital, psychic and spiritual aspects of the human personality.

Education is the searching knowledge from known to unknown and it makes an individual a real human being. Education is an essential human virtue and is a mental tool for training and exercise of intellectual functions. Due to its unique role in solving everyday problems, it has occupied a significant position in the human life. It has enabled individuals, whether in developing and developed countries, to become academicians, teachers, entrepreneurs, leaders and administrators.
1.1 BACKGROUND OF THE STUDY

Over the years, so many researches have been conducted on teaching-learning process. New methods and techniques have been developed on the basis of research findings. The traditional methods and techniques have been replaced by new techniques in the last two decades in western countries. We can also benefit from these new methods and techniques, if we faithfully implement them in our classroom communication. The advanced countries have reached a state where the ideas, ideologies and even the object of faith are being examined from specific perspective. People were conscious to educate their children in a way so as to enable them to cope with the personal and social problems obvious in a modern complex society due to the influence of scientific, technological and industrial progress.

Teachers are the prime agents of change who prepare the individuals to explore new horizons and to achieve higher level of progress and development. The teacher of today neither consider the child as a vessel waiting to be filled up with facts, nor as a playable plastic material which can be transformed into any shape enabling him to project his ideas on it. The modern teacher considers each child as a plant and helps the child to grow according to his abilities and aptitudes. The quality of a nation depends invariably on the quality of its educational system that imparts purpose and vision of past, present and future to her own people. Education is the teacher’s noble mission to reveal the intellectual and creative potentials of every pupil as far as possible to make everyone competent to meet the present day problems.

In the modern era, learning and teaching are much different from the traditional face to face educational environment. Teachers and students do not need to get together at a particular time and the role of teachers changed from speakers to assistants and the students changed from listeners to active participants. Fundamental changes have taken place in the basic process of our
thinking and these are beginning to affect profoundly our everyday life. According to Confucius (510 BC) “The wise man in his teaching, guides his students but does not pull them along, he urges them to go forward and does not suppress them, and he opens the way but does not take them to the place. If his students are encouraged to think for themselves we may call the man a good teacher.”

The needs of the society determine the nature of education. The developments occurred in the field of Science and Technology has caused a drastic methodological shift in our education system. The challenges facing education systems have a direct impact on us.

**Importance of learning Mathematics**

Mathematics is one of the most important contributing factors in the rapid progress and prosperity of human race. The knowledge of fundamental process of Mathematics and the skills to use them are the preliminary requirements of the human being in these days. It is the gate and key to all success. The world of today, which learn more and more heavily on science and technology, demands more and more mathematical knowledge and part of more and more people. Mathematics thinking is important of modern society as habit of mind for its use in the workplace, business and finance and for personal decision making. Mathematics is fundamental to national prosperity in providing tools for understanding Science, Engineering, Technology and Economics.

It is essential for public decision making and for participations in knowledge economy. Mathematics is a creative discipline. The subject transcends boundaries and its importance is universally recognized. Mathematics is in one culture and is a vehicle of progress of all other sciences. It helps the man to give exact interpretation to his ideas and conclusions. It enables the man to study various phenomena in space and establish various
relationships between them. It is also the prime vehicle for developing students higher order cognitive skills.

According to Courant and Robins (1996) “Mathematics is an expression of human mind, reflect the active will, contemplative reason and to desire of aesthetic perfection. Its basic elements are logic and intuition, analysis and instruction, generality and individuality”. Mathematics, therefore, is not only ‘number work’ or ‘computation’, but is more about forming generalization, seeing relationships and developing logical thinking and reasoning. The National Policy of Education (NPE) (1986) stated “Mathematics should be as a vehicle a child to think, reason, analyze, and articulate logically”. Mathematics should be shown as a way of thinking, an art or form of beauty and as human achievement. Mathematics is the only subject that encourages and develops logical thinking. It enables the students to discriminate between essentials and non-essentials. It helps them to swift facts, to draw conclusions tersely and without ambiguity and that is a subject by which they may learn, what is meant by rigid reasoning. Therefore the inclusion of Mathematics as a compulsory subject is very essential for training rational, trustworthy and useful citizens, in a democratic society. The Kothari commission (1964-66) emphasized the significance of Mathematics in the school curriculum by stating “one of the outstanding characteristics of scientific culture is quantification”. Mathematics, therefore assumes a prominent position in modern education. The advent of automation and cybernetics in this century marks the beginning of the industrial revolution and make it all the more imperative to devote special attention to the study of Mathematics. Proper foundation in the knowledge of the subject should be laid at school. Therefore due to the importance of Mathematics education, innovative teaching methods are very much essential.

Mathematics offers a way of doing things, to be able to solve Mathematical problems, and more generally, to have the right attitude for
problem solving and to be able to approach all kinds of problems in a systematic manner (National Curriculum Framework, 2005). The basic characteristic of Mathematics is the analysis and interpretation of the world through numbers. It is the study of patterns abstracted from the world around us. So anything we learn in Mathematics has literally thousands of applications, in arts, sciences, finance, health and leisure. It is truly the global language. Mathematics equips pupils with a unique powerful set of tools to understand and change the world. Mathematics is one of the most important contributing factors in the rapid progress and prosperity of human race. The knowledge of fundamental process of Mathematics and skills to use them are the preliminary requirements of a human being in these days. It is the gate and key to all success.

The world today is witnessing developments and changes coming too fast, demanding immediate attention. Every learner in a dynamic learning society has to be familiar with such areas of knowledge. In various disciplines in the global context education must facilitate learner’s personal growth and psychologically equip them to cope with the rapid changes taking place in all spheres of life. Thus the focus of education is moving away from providing mere cognitive skills to preparing students to face the challenges of life. It is in this context, the theories of constructivism and multiple intelligences influence the process of education and gain much relevance.

Theories of learning and development have some implications in the classroom teaching. A teacher can always act upon these theories for teaching children in the classroom. But these theories are sometimes inadequate for the development of a theory of teaching and maximizing learning on the part of pupils. Further it is mentioned that theories of learning and development are descriptive in nature. A theory of teaching, on the other hand is prescriptive in the sense that it sets forth rules concerning the most effective ways of helping children to achieve knowledge skills etc. A theory also provides a measure for
evaluating any particular way of teaching. Theories of learning describe the process of learning and a theory of teaching, on the other hand sets forth the rules for improving pupil's learning.

**PATH-SMOOTHING MODEL**

A model of teaching consists of guidelines for designing educational activities and environments. Models of teaching are meant for creating suitable learning environments. They provide specifications for constructing learning situations. Each model represents a view on what is important to learn and how it should be learnt. Bruce Joyce and Marsha Weil (1996) describe a model of teaching as a description of learning environment. The description have many uses ranging from planning curriculum, courses, units and lessons to designing instructional materials such as books, work books, multimedia programmes and computer assisted learning programmers.

Path-Smoothing Model emphasizes repetitive rather than insightful activities, almost all teachers who use it as their basic approach will also consciously offer some insightful experiences.

First, the main features of the model, the essential methodology of which is to smooth the path for the learner:

1. The teacher or text states the kind of problem on which the class will be working. The teacher or text attempts to classify the Subject matter into a limited number of categories and to present them one at a time. There is an implicit assumption that, from the exposition, pupils will recognize and identify with the nature of the problem being posed.

2. Pupils are led through a method for tackling the problems. The key principle is to establish secure pathways for the pupils. Thus it is important to present ways of solving problems in a series of steps which is as short as possible, and often only one approach is considered
seriously. Teachers question pupils, but usually in order to lead them in a particular direction and to check that they are following.

3. Pupils work on exercises to practice the methods given aimed at involving learners more actively. These are usually classified by the teacher or text writer and are graded for difficulty. Pupils repeat the taught processes until they can do so with the minimum of error.

4. Longer term failure is dealt with by returning to the same or similar subject matter throughout the course; i.e., revision.

Teacher attempts to give clear explanations, or encourage pupils to gather data about particular cases before offering a generalization. However, there is usually a pressure of time felt by teachers, and consequently by their pupils, to move on to the 'work', which is perceived as doing exercises. The teacher may find the time to offer explanations but not to provoke the debate needed to clarify meanings. Inevitably, pupil perceptions remain unexamined if they passively agree to the arguments in order that work can proceed. So attempts to justify and explain, although genuine in intent, can fail to convey understanding to the pupils. It is important to note that the model is perpetuated in most textbook schemes. Individualized schemes almost inevitably follow the model, because they are dependent on the pupil, being able to take small manageable steps, without constantly referring to others. So does any approach which basically uses a sequence of pre-structured questions and does not give pupils the space to explore their own responses to situations or to participate in making significant choices for themselves. The structured investigations attempts to reduce exploratory work to a series of algorithms or pattern-spotting exercises. Teachers who hold to this model of teaching and learning certainly exercise professional care for their pupils and help them to achieve an important measure of success in public examinations. This care is shown in a variety of ways: by providing a structured framework with a clear work pattern, by marking the pupil's work on a regular basis and explaining where the pupil has gone wrong, by being available to sort out difficulties as they arise. As to
public examinations, these tend to fall into a set pattern over the years and are therefore often amenable to a Path-Smoothing Model. The model is also one which parents and the public can recognize a popular, if only partial, view of how learning takes place. These are the pre-eminent reasons as to why the model is so persistent in the face of an increasing body of knowledge and understanding about learning which tells a more complex story.

**CREATIVE PROBLEM SOLVING**

Creative Problem Solving is a form of deliberate creativity: a structured process for solving problems or finding opportunities, used when you want to go beyond conventional thinking and arrive at novel and useful solutions. It is a proven method for approaching a problem or a challenge in an imaginative and innovative way. It is a tool that helps people to redefine the problems they face, come up with breakthrough ideas and then take action on these new ideas.

Creative Problem Solving is the mental process of creating a solution to the problem. It is a special form of problem solving in which the solution is independently created rather than learned with assistance. Creative Problem Solving always involves creativity. However creativity often does not involve Creative Problem Solving especially in fields such as music, poetry and art. Creativity requires newness or novelty as a characteristic of what is created, but creativity does not necessarily imply that what is created has value or is appreciated by other people. Problem Solving techniques are also useful even in our professional life when we have to deal with emergencies and difficult situations.

Creative Problem Solving differs from routine problem solving. Creative Problem Solving involves a hunt for new solutions, while routine problem solving uses old solutions. Creative Problem Solving activities should be given great importance in educational institutions by organizing quizzes, asking students to solve Riddles, Puzzles and Mathematical sums.
PERCEPTUAL SPEED

Perceptual Speed is the ability to quickly and accurately compare letters, numbers, objects, pictures or patterns. In tests of Perceptual Speed the things to be compared may be presented at the same time or one after the other. Candidates may also be asked to compare a presented object with a remembered object. Example: Many aptitude tests and IQ tests measure candidate’s Perceptual Speed, including the Thomas International General Intelligence Assessment. One of the primary mental abilities in visual thinking that has been identified repeatedly is Perceptual Speed.

Perceptual Speed refers to the rate of the power or act of perceiving. It reflects the speed of apprehension. The nature of thought, perception and learning are some of the highly indefinable and abstract variables which contribute to our human ability to succeed, conquer and excel in the tasks which we encounter every day. The specific aspects of human mental abilities and multiplicity of human thought which define our level of intelligence have always been the point of discussion for Psychologists. It is the ability to rapidly compare visual configurations and identify two figures as similar or identical or to identify some particular details that buries in distracting material. Perceptual Speed is one test in a battery designed to establish a profile of stores on a selection of well known primary mental abilities.

1.2 NEED AND SIGNIFICANCE OF THE STUDY

Mathematics is not a subject to be talked about. It should be learned through a disciplined and systematic approach. Teaching of Mathematics should not be done through mere lecturing.

In education there is no common view about the different objectives of teaching. There are different interpretations of the same objective by different people. With the help of Path-Smoothing Model, teacher is able to define and
translate the objectives in the same way. This will facilitate the exchange of
information, curricular development and evaluation of devices. It will also help
in modifying the educational outcomes. According to thinkers of ancient India,
Education is a third eye of a person. It gives him insight into all affairs. It
teaches him how to act justly and rightly. It leads him to realize the true
significance of life. There are a number of new strategies and techniques
evolved in the educational area also. Students receiving education today should
be competent to face the realities of tomorrow. Therefore the educational
system imparted is to be strengthened to meet the challenges of new century.

Generally students are afraid of studying Mathematics and one of the
major reasons is the use of inappropriate teaching method. The people tend to
learn Mathematics through a meaningful approach rather than by a mechanical
process. The result of rote learning is the improper understanding of the subject
and the version towards the subject. Both the content and methodology have
prominent roles to play in making the subject easier.

It is the duty of a teacher to apply the proper teaching method to make
teaching more attractive. Creative Problem Solving improves the student’s
thinking ability. It can be enhanced and developed through systematic training.
In the classroom situation, students know and understand the Mathematics
concept and rules but unable to apply to a new situation or problem. It needs
proper training. The Mathematical activities in Creative Problem Solving
improve pupil’s capacities for understanding and in developing general thought
processes.

The Path-Smoothing Model is used for improving the teaching –
learning processes and it develops creativity as well as application skills in all
students. So this new strategy of teaching will be a great help to our system of
instruction. Path-Smoothing Model will be a light to the difficulties faced in
Mathematics learning and learning will become interesting and enthusiastic.
Hence a study is envisaged to find out the Effectiveness of an Instructional Strategy based on Path- Smoothing Model on Creative Problem Solving Ability, Perceptual Speed and Achievement in Mathematics of students at Secondary Level. The study will be helpful for all the teachers and students, gifted students in Mathematics as well as backward students.

1.3 STATEMENT OF THE PROBLEM

The present study has been undertaken to develop and to find the effect of an instructional Strategy based on Path-Smoothing Model on Creative Problem Solving Ability, Perceptual Speed and Achievement in Mathematics of Students at Secondary Level. Hence the study is entitled ‘EFFECTIVENESS OF AN INSTRUCTIONAL STRATEGY BASED ON PATH-SMOOTHING MODEL ON CREATIVE PROBLEM SOLVING ABILITY, PERCEPTUAL SPEED AND ACHIEVEMENT IN MATHEMATICS OF STUDENTS AT SECONDARY LEVEL’

1.4 DEFINITION OF KEY TERMS

1 Effectiveness

The term Effectiveness defines the adequacy to accomplish a purpose or the capacity to produce the intended result (Webster’s English Dictionary, 1989).

The term Effectiveness can be operationally defined as the impact of the Instructional Strategy.

2 Instructional Strategy

The art of cleverly managing the act of providing activities, materials and guidance and facilitate teaching / learning in either formal or informal situations to promote the attainment of particular type of objectives (Heinich, 1989)
Instructional Strategy can be operationally defined as the different technique or style of teaching Mathematics for Secondary Level students for improving Creative Problem Solving Ability, Perceptual Speed and Achievement in Mathematics.

3 Path-Smoothing Model

Path-Smoothing Model is a model which emphasizes repetitive rather than insightful activities to make the subject in curriculum easier and smoother. (Alan Wigley, 1992)

In this study, Path-Smoothing Model is a model which helps to make Mathematics subject in curriculum easier and smoother.

4 Creative Problem Solving

Creative Problem Solving process is defined as the emergence in action of a novel relational product growing out of the uniqueness of the individual on one hand and the materials, events, people or circumstances of his life on the other. (Roger, 1951)

Creative Problem Solving can be operationally defined as the novelty in Problem solving method.

5 Perceptual Speed

Perceptual Speed is the rate of pertaining to Perception. (The Webster’s English Dictionary, 1989)

Perception is the way we notice things, especially with senses and the ability to understand things quickly. (The Oxford Advanced Learner’s Dictionary, 2010)

Perceptual Speed can be operationally defined as the ability to quickly and accurately compare letters, numbers, objects, pictures or patterns.
6 Achievement

Achievement is the accomplishment or proficiency of performance in a given skill or body of knowledge. It is the knowledge attained or skill developed in a school subject usually designated by test scores or marks assigned by the teacher (Webster’s English Dictionary, 1989).

In this study, Achievement refers to accomplishment in the Mathematics subject based on the Objectives: Knowledge, Understanding, Application, Analysis, Synthesis and Evaluation of students at Secondary Level.

7 Secondary Level

Secondary Level students are those students studying in any school recognized by Government of Kerala at the terminal stage of school education, specifically students of eighth, ninth and tenth standards. (Webster’s English Dictionary, 1989)

In the present study, Secondary Level students are the students studying in eighth standard.

1.5 OBJECTIVES OF THE STUDY

The objectives of the study are:

1. To analyse the present status of Mathematics Teaching at Secondary level
2. To develop an Instructional Strategy based on Path-Smoothing Model.
3. To find out the Effectiveness of the Instructional Strategy based on Path-Smoothing Model and Activity Oriented Method on Creative Problem Solving Ability of students at Secondary Level for total sample and relevant subsamples.
4. To compare the Effectiveness of the Instructional Strategy based on Path-Smoothing Model and Activity Oriented Method on Creative
Problem Solving Ability of students at Secondary Level for total sample and relevant subsamples.

5. To find out the Effectiveness of the Instructional Strategy based on Path-Smoothing Model and Activity Oriented Method on Perceptual Speed of students at Secondary Level for total sample and relevant subsamples.

6. To compare the Effectiveness of the Instructional Strategy based on Path-Smoothing Model and Activity Oriented Method on Perceptual Speed of students at Secondary Level for total sample and relevant subsamples.

7. To find out the Effectiveness of the Instructional Strategy based on Path-Smoothing Model and Activity Oriented Method on Achievement in Mathematics of students at Secondary Level for total sample and relevant subsamples.

8. To compare the Effectiveness of the Instructional Strategy based on Path-Smoothing Model and Activity Oriented Method on Achievement in Mathematics of students at Secondary Level for total sample and relevant subsamples.

9. To assess the retention effect of the Instructional Strategy based on Path-Smoothing model and Activity Oriented Method on Creative Problem Solving Ability, Perceptual Speed and Achievement in Mathematics of students at Secondary Level.

1.6 HYPOTHESES OF THE STUDY

The hypotheses formulated for the study are:

\( H_{(1)} \) There will be significant difference in Creative Problem Solving Ability of Students at Secondary level taught through the Instructional Strategy based on Path-Smoothing Model and Activity Oriented Method for the total sample.

\( H_{(2)} \) There will be significant difference in Creative Problem Solving Ability of Students at Secondary level taught through the Instructional Strategy based on
Path-Smoothing Model and Activity Oriented Method for the sub samples based on Gender and Type of Management.

\( H_3 \) There will be significant difference in Perceptual Speed of Students at Secondary level taught through the Instructional Strategy based on Path-Smoothing Model and Activity Oriented Method for the total sample.

\( H_4 \) There will be significant difference in the Categories of Perceptual Speed of Students at Secondary level taught through the Instructional Strategy based on Path-Smoothing Model and Activity Oriented Method.

\( H_5 \) There will be significant difference in Perceptual Speed of Students at Secondary level taught through the Instructional Strategy based on Path-Smoothing Model and Activity Oriented Method for the sub samples based on Gender and Type of Management.

\( H_6 \) There will be significant difference in Achievement in Mathematics of Students at Secondary level taught through the Instructional Strategy based on Path-Smoothing Model and Activity Oriented Method for the total sample.

\( H_7 \) There will be significant difference in Achievement in Mathematics based on the Objectives of Students at Secondary level taught through the Instructional Strategy based on Path-Smoothing Model and Activity Oriented Method.

\( H_8 \) There will be significant difference in Achievement in Mathematics of Students at Secondary level taught through the Instructional Strategy based on Path-Smoothing Model and Activity Oriented Method for the sub samples based on Gender and Type of Management.

\( H_9 \) There will be significant difference in the Retention of Creative Problem Solving Ability of the Students at Secondary Level taught through the Instructional Strategy based on Path-Smoothing Model and Activity Oriented Method.
There will be significant difference in the Retention of Perceptual Speed of the Students at Secondary Level taught through the Instructional Strategy based on Path-Smoothing Model and Activity Oriented Method

There will be significant difference in the Retention of Achievement in Mathematics of the Students at Secondary Level taught through the Instructional Strategy based on Path-Smoothing Model and Activity Oriented Method

1.7 METHODOLOGY IN BRIEF

The present study is intended to find out the Effectiveness of an Instructional Strategy based on Path-Smoothing Model on Creative Problem Solving Ability, Perceptual Speed and Achievement in Mathematics of students at Secondary Level. So Experimental method was adopted for the study.

1.7.1 Experimental Design of the Study

For the experiment, the design selected was Pre-test Post-test non-equivalent group design.

1.7.2 Variables of the Study

The variables are the conditions or characteristics, the experimenter manipulates controls or observes. The variables involved in this study are,

a. Independent variables: The Instructional Strategy based on Path-Smoothing Model and Activity Oriented Method of teaching were the two independent variables selected for this study.

b. Dependent Variables: Creative Problem Solving Ability, Perceptual Speed and Achievement in Mathematics were selected as the dependent variables of the study.

c. Extraneous Variables: General Mental Ability, Previous Achievement in Mathematics, Age level of students, Teacher
Factors, Time of Instruction were considered as extraneous variables for this study.

1.7.3 Sample Selected for the Study

The investigator selected a sample of 296 Secondary school students from 4 schools in Thrissur District following Kerala state syllabus, through random sampling method of which 148 students as Experimental group and 148 as Control group.

1.7.4 Tools Used for the Study

Tools are the instruments employed for collecting the necessary data.

1. Questionnaire on the present status of Teaching Mathematics.

2. Lesson Transcripts on Instructional strategy based on Path-Smoothing Model (Prepared by the Investigator)

3. Lesson Transcripts on Activity Oriented Method. (Prepared by the Investigator)

4. Creative Problem Solving Ability Test (Prepared and Standardized by the Investigator)

5. Perceptual Speed Test (Prepared and Standardized by the Investigator) including the following sub tests.

i) Perceptual Speed Sub Test- I (Number Comparison Test)

ii) Perceptual Speed Sub Test-II (Word Comparison Test)

iii) Perceptual Speed Sub Test-III (Alpha Numeral Comparison Test)

iv) Perceptual Speed Sub Test-IV (Mathematical Operation Comparison Test)
1.7.5 Procedure Adopted for the Study

A preliminary survey was conducted to collect information from Secondary School Mathematics teachers about the present status of teaching Mathematics at Secondary Level.

For conducting the experiment, investigator selected 296 Secondary School Students following Kerala State Syllabus from 4 schools of Thrissur district. The students of Eighth standard were selected for the study. From the population, sufficient sample for the experimental study was taken using Random Sampling technique, giving due importance to Gender and Type of School Management. Both the experimental group and control group consisted of 148 students each. Before starting the experiment, the previous Achievement in Mathematics and the General Mental Ability of the students were found out. Then the Creative Problem Solving Ability test, Perceptual Speed and Achievement in Mathematics were given as Pre-Tests. The experimental group was taught using the Instructional Strategy based on Path-Smoothing Model and control group was taught using Activity Oriented Method. After this, the Creative Problem Solving Ability Test, Perceptual Speed Test and Achievement in Mathematics were given as Post Tests.
In order to understand the retention of these groups on the variables, the same Post-tests were administered one month after the administration of Post-test (Delayed Post-test). The investigator tried to maintain same conditions with regard to the time allotted, instructions given during the test etc, for all the groups. The response sheets were collected back and scored.

1.7.6 Statistical Techniques Used

In order to find out the Effectiveness of the Instructional Strategy based on Path-Smoothing Model on Creative Problem Solving Ability, Perceptual Speed and Achievement in Mathematics of Students at Secondary Level, t-test is done using Pre-test Post-test scores. The classroom intact groups may be similar, but they are non-equivalent groups. Since the experiment is conducted using class room intact groups, Analysis of Variance (ANOVA) and Analysis of Covariance (ANCOVA) is applied for analyzing the final scores.

1.8 SCOPE OF THE STUDY

The main objective of the study is to find out the effectiveness of the Instructional Strategy based on Path-Smoothing Model on Creative Problem Solving Ability, Perceptual Speed and Achievement in Mathematics of students at Secondary Level. This Instructional Strategy helps the students to improve Creative Problem Solving Ability and Perceptual Speed thereby enhancing the Achievement in Mathematics. This Instructional Strategy will help the students to develop their Creative Problem Solving Ability and Perceptual Speed also helps to give concrete and very meaningful way of learning Mathematics and.

This Instructional Strategy helps the teachers to give meaningful way of learning Mathematics to the students and to achieve more in Mathematics and also to improve various skills such as Creative Problem Solving Ability and Perceptual Speed. It is hoped that the findings of the study will create awareness among the teachers, state authorities and curriculum planners regarding the need for developing innovative strategies like Path-Smoothing
Model. Path-Smoothing model will be a light to the difficulties faced in Mathematics learning and thus learning will become interesting and enthusiastic.

The results of the study will motivate the teachers and state resource group to use this model to follow and develop similar materials. A true picture of the various aspects of Path-Smoothing Model will be useful to the Mathematics teachers in our state. It is presumed that a study of this will be helpful for the curriculum planners for defining better Mathematics curriculum. It will provide useful information to curriculum planners and course book designers to replicate more such innovative strategies.

1.9 LIMITATIONS AND DELIMITATIONS OF THE STUDY

Despite of all possible precautions take up to arrive at reliable results, certain limitations have crept into the study which are inevitable in the case of the study of this type. It is presumed that the procedure adopted for the present study is adequate enough to throw light on the problems under investigation. Some of the limitations are,

The study is confined to Secondary School students in Mathematics following the state syllabus. Due to the time limit, the sample for the study is limited to 296 Secondary School students in Mathematics from Thrissur district. More generalized results would have been obtained, if more districts and more schools from those districts were taken into consideration. The study is not attempted to any other sections like primary, upper primary, higher secondary and college level. Only the units from VIII\textsuperscript{th} standard was taken for experimentation.

Only three variables such as Creative Problem Solving Ability, Perceptual Speed and Achievement in Mathematics were considered for experimentation. All possible dependent variables, which can depend on this strategy, were not selected due to the constraints of time. Only very few
reviews on the Independent variables that is Path-Smoothing Model is obtained.

However within the constraints set, an attempt has been made by the investigator to make the study as reliable and generalisable for Mathematics learners and teachers. The investigator hopes that the findings of the study will be of use to teacher and other educational workers in understanding the application of the new teaching techniques discussed and the potentials of these techniques in realizing the objectives of teaching Mathematics. It is hoped that the results of the present study would be helpful in finding new frontiers in the field of education.

1.10 ORGANIZATION OF THE REPORT

The research report consists of six chapters

Chapter 1: Introduction

This chapter consists of a general introduction highlighting the significance of the Path-Smoothing Model, Creative Problem Solving Ability, Perceptual Speed and Achievement in Mathematics of students at Secondary Level. This chapter also reveals the rationale for selecting the problem, statement of the problem, identification of the key terms, objectives of the study, hypotheses of the study and the brief discussion on the scope and limitations of study.

Chapter 2: Conceptual Framework

This chapter deals with the theoretical basis of Path-Smoothing Model, Creative Problem Solving Ability, Perceptual Speed and Achievement in Mathematics.
Chapter 3: Review of Related Literature

A brief review of related studies as well as scholarly works done by the researcher with more proximity to the present one is included in third chapter.

Chapter 4: Methodology

It discusses about the methodology adopted for the study including the variables used, design of the study, selection of the sample, preparation of materials, tools used for the study and statistical procedure adopted.

Chapter 5: Analysis and Interpretation of Data.

It deals with the analysis and interpretation of data collected during the courses of the study.

Chapter 6: Summary, Findings, Conclusion and Suggestions

This chapter presents summary of the procedures adopted in the study followed by conclusions, educational implications and suggestions for further research.