INFLUENCE OF LEARNING STYLES ON MATHEMATICS SELF-EFFICACY OF SECONDARY SCHOOL STUDENTS

NIMISHA THILAK. A

Dissertation
Submitted to the University of Calicut for
Partial Fulfillment of the Requirements for the Degree of

MASTER OF EDUCATION

FAROOK TRAINING COLLEGE
RESEARCH CENTRE IN EDUCATION
UNIVERSITY OF CALICUT

2020

DECLARATION

I, **NIMISHA THILAK. A**, do hereby declare that this dissertation entitled, **INFLUENCE OF LEARNING STYLES ON MATHEMATICS SELF-EFFICACY OF SECONDARY SCHOOL STUDENTS,** has not been submitted by me for the award of any Degree, Diploma, Title or Recognition before.

Farook College
Date: .07.2020 **NIMISHA THILAK.A**

CERTIFICATE

I, **Dr. NIRANJANA K. P.**, do hereby certify that the dissertation entitled, **INFLUENCE OF LEARNING STYLES ON MATHEMATICS SELF-EFFICACY OF SECONDARY SCHOOL STUDENTS** is a record of bonafide study and research carried out by **NIMISHA THILAK.A,** of M.Ed Programme (2018-20), under my supervision and guidance, and has not been submitted by her for the award of any Degree, Diploma, Title or Recognition before.

Farook College
Date: .07.2020

Dr. NIRANJANA K.P
Supervising Teacher

ACKNOWLEDGEMENTS

The investigator is deeply indebted to her supervising Teacher and M.Ed co-ordinator, ***Dr. Niranjana K. P****., Assistant Professor, Farook Training College, for her constant encouragement, generous help and valuable suggestions combined with expert criticism. The investigator would like to express her profound gratitude to,* ***Dr. T. Mohamed Saleem****, Principal, Farook Training College, for his whole hearted co-operation in extending the facilities and encouragement to conduct this study. Then the investigator extend her keen heart felt thanks and regards to* ***Dr. C.A Jawahar****, former Principal of Farook Training College for his constant encouragement and support to complete the work.*

The investigator extends her sincere gratitude to all faculty members especially to ***Dr. N. S. Mumthas,*** *for permitting to adopt the tool,* ***Dr. K. Vijayakumari*** *for providing expert guidance at various stages of dissertation work, Librarian, library staff, and office staff of Farook Training College, for their support and encouragement throughout the study. The investigator expresses thanks to her friend and senior* ***Mrs. Ganisha T.V.*** *for helping to complete the work effectively.*

Finally the investigator is deeply indebted to her parents for providing whole-hearted support and help to complete the work successfully.

Farook Training College **NIMISHA THILAK. A**

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER 1
INTRODUCTION

- Need and Significance of the study
- Statement of Problem
- Definition of Key Terms
- Variables Selected for the Study
- Objectives of the Study
- Hypotheses of the Study
- Methodology in Brief
- Scope of the Study
- Limitations of the Study
- Organization of the Report

Learning math is very important since it is the major instrument for future development of science and technology. Mathematics is regarded as the "queen of the sciences" as it is the base of science and technology that have made our life easy and comfort. Mathematics is used in number of areas, because it provides a precise way to describe complicated situations and analyses difficult problems. Thus, the progress of a society depends largely on development of math education. According to Becon “Mathematics is the gateway and key of the sciences, neglect of mathematics works injury to all knowledge; since one who is ignorant of it cannot know the other things of the world, and what is worse, men who thus ignorant are unable to perceive their own ignorance and so do not seek a remedy” (*c.f.* Kline, 1969)

Mathematics education is essentially a practical discipline, where the underlying goal is always to promote better learning of mathematics for the students. It benefits both individual and society through its contribution to the science, economy, engineering etc. It can empower individuals in everyday life, bring them personal fulfillment through studying its beautiful patterns and working on its magnificent problems. National Policy on Education (1986) suggested that, “Mathematics should be visualized as the vehicle to train a child to think, reason, analyze and to articulate logically”.

Mathematics is an important subject of school curriculum and is necessary in daily living as well as in the study of other subjects. Vocations, profession, administration, industries and all institution, use a good deal of mathematics, as

well farmers, doctors, engineers, clerks, painter, tailors, chemists and mechanics scare or fail in their profession by their lack of skills in mathematics, each detail of their vocation needs mathematical precision and predications (Vasanthi, 2000). By accepting the importance of mathematics, Education Commission (1964-66) recommend compulsory study of mathematics for the first ten years of schooling.

At secondary school level, effective transaction of the concepts is prevailing as a major problem for teachers as well as students. For removing this inadequacy, educators have explored emerging theories about how people learn and studied different types of learning styles used by the students. The research findings on learning styles offer substantial promise to teachers, counsellors and the students themselves in terms of finding better ways to learn how to act intelligently when learning seems to be a difficult process. Learning style theories help the teachers to understand their learners and then developing a variety of instructional methodologies to benefit all learners; recognize the incredibly diverse needs learners bring into the classroom and helping the learners discover how they learn best for optimum academic achievement (Nzesei, 2015).

Sriphai, Damrongpanit and Sakulku (2012) indicated that learning styles as a factor influencing mathematics achievement had a greater coefficient of determination than the one without learning styles; the effect of learning styles treated as exogenous variables had a greater coefficient of determination than learning styles treated as endogenous variables; and the changes in the regression coefficient as well as changes in relations between factors influencing mathematics achievement showed that learning styles was a moderator variable.

Once teachers are aware of the unique learning styles of students, they will have the capacity to adjust their teaching approaches to best fit to their students' learning preferences. This awareness forces the teachers to have a self-reflection on the current teaching methodologies they use and leads to a refinement. The understanding of learning styles of children helps the parent to assist and reinforce their children to acquire skills needed for successful schooling (Sabatova, 2008). Thomas(2014) reported that the study of learning style preferences helps the teachers to match the learning tasks with the learning styles of students and design mathematics curriculum accordingly. The study also advocated that various patterns of cooperative learning can be implemented in schools for the effective transaction of mathematics curriculum in as relaxed and friendly atmosphere based on the learning preference of pupils.

Need and Significance of the Study

Majority of our students find difficult to learn and score high in mathematics and a common belief prevails that the majority of students dislike mathematics. Gafoor and Kurukkan (2005) conducted a study to identify the difficulties felt by students in learning mathematics. The results revealed that major reasons to dislike mathematics were related to difficulty in understanding the subject matter, and teacher or instructional related factors. When 20 percent of students rated mathematics as a very difficult subject, 54 percent of students reported medium difficulty, with only 10 percent of students considered it as an easy subject. Around 42 percent of students fail to identify the ways to solve problems provided in their

textbook. A large division of students use blind strategies in learning mathematics and possess less adaptive self-efficacy beliefs and epistemological beliefs.

Social cognitive theorists have suggested that peoples' judgements of their own capabilities to accomplish specific tasks strongly influence human motivation and behaviour (Bandura, 1986). According to Bandura's (1997) social cognitive theory, self-efficacy has an important role in students' achievement. This is because self-efficacy judgements are said to mediate the influence of other predictors of behaviour on a particular performance. In mathematics, for example, the confidence that student has in their own ability helps to determine what they do with the knowledge and skills they possess. Consequently, the influence of actual ability on some academic performance is due, at least in part, to what students actually believe they can accomplish. Prior determinants such as ability and previous performance attainments help to create self-efficacy perceptions and are also strong predictors of subsequent performance. However, peoples' perceptions of their efficacy touch, at least to some extent, almost everything they do (Bandura, 1984).

Relationships between students' maths self-efficacy and maths achievement have been well-researched overseas. Ayotolaa and Adedejib (2009) identified that there exist a strong positive relationship between mathematics self-efficacy and achievement in mathematics among senior secondary students of Oyo state. They also recommend that teacher should find ways of enhancing mathematics self-efficacy among students and should place emphasis on student's confidence to succeed in mathematics achievement. Liu and Koirala (2009) studied the relation between mathematics self-efficacy and mathematics achievement among 10^{th} grade

students of United State. The results of the correlation analysis indicated that mathematics self-efficacy and mathematics achievement were positively related. Students with high mathematics self-efficacy were associated with high mathematics achievement. Regression analysis also indicated that mathematics self-efficacy was a significantly positive predictor of mathematics achievement.

Among the various factors, researches showed that learning style influences the self-efficacy in particular task across the domains. Zarei, Esfandiari and Hosseini (2016) identified that language learning styles and strategies as predictors of computer use anxiety and computer self-efficacy. West, Kahn and Nauta(2007) studied the relation between learning style and research self-efficacy. The results showed that students with more active (vs. reflective) and more intuitive (vs. sensing) learning styles reported greater research self-efficacy, and students with more intuitive (vs. sensing) and more verbal (vs. visual) learning styles reported greater research interest. Ishak and Awang (2017) showed that there is no significant difference between learning styles based on gender at the same time Kahramanoğlu and Deniz (2017) revealed that women are dominated by the visual and auditory learning styles.

The study conducted by Arbabisarjou, Sotoudeh, Zare, Shahrakipour and Ghoreishinia (2016) found significant relationship between student's gender and their efficacy. Females showed a higher level of efficacy. Despite this there wasn’t any significant relationship between student's gender and their learning styles. The results of ANOVA showed a significant influence of student's learning styles and efficacy. The findings of the study reported that, learning styles could help in

predicting one's efficacy and self-efficacy is an important factor in someone's success. Results of the study also suggested that the professors should use optimum learning methods by considering student's learning styles.

The teachers should be aware of students' affective beliefs and inter-relations of those in learning mathematics so as to employ more effective strategies in teaching and to improve students' mathematics learning by reducing their negative beliefs. For this the teachers should have a clear idea of mathematics self-efficacy of students and the factors affecting mathematics self-efficacy of students. Review of studies indicated that much less is studied about how the learning style influences the mathematics self-efficacy of students. Hence the present study was designed to investigate the influence of learning styles on mathematics self-efficacy of secondary school students. The results of the study is beneficial to policy makers, administrators, teachers and parents to train students for adopting effective learning style in mathematics and to enhance mathematics self efficacy of students.

Statement of the Problem

The present study is entitled as;

INFLUENCE OF LEARNING STYLES ON MATHEMATICS SELF-EFFICACY OF SECONDARY SCHOOL STUDENTS

Definitions of Key Terms

- *Influence*

Influence is the power or ability to affect someone's beliefs or actions (Compact Oxford Dictionary, 2004).

For the present study, Influence is the capacity of Learning Styles to have an effect on the Mathematics Self-Efficacy of secondary school students.

- *Learning Styles*

Learning styles is the composite of characteristics cognitive, affective and psychological factors that serve as relatively stable indicators of how a learner perceives, interacts with and responds to the learning environment (Keefe, 1979).

For the present study, Learning styles is defined as ways of learning preferred by students in learning mathematics in terms of Activist, Reflector, Theorist and Pragmatist learning styles as measured by using Learning Style Inventory.

- *Mathematics Self-Efficacy*

Bandura (1997) defined mathematics self-efficacy as one's beliefs or perceptions with respect to their abilities in mathematics. Mathematics self-efficacy is one's conviction or confidence in their abilities to solve problems in mathematics.

Ferla, Valcke and Cai (2015) posited that mathematics self-efficacy indicates individual's self-perceived confidence to successfully accomplish a particular mathematics task.

For the present study, Mathematics self-efficacy refers to beliefs or perceptions of students with respect to their abilities to solve problems in Mathematics, using Mathematics in everyday task and obtaining good grades in Mathematics courses as measured by using Scale on Mathematics Self-Efficacy.

- *Secondary School Students*

The secondary school students refer to those students studying in Vlll, IX and X standards of high schools in Kerala.

For the present study secondary school students means those students studying in Eighth standard of high schools in Kerala state.

Variables Selected for the Study

The variables selected for the present study are:

Independent Variable: Learning Styles

Dependent Variable: Mathematics Self-Efficacy

Objectives of the Study

The objectives of the study are:

1. To identify the type of Learning Style preferred by the secondary school students for total sample and subgroups based on gender, type of management of schools and locale of schools.
2. To find out the extent of Mathematics Self-Efficacy of secondary school students.

3. To analyze whether there exist any significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students for the subgroups based on gender, type of management of schools and locale of schools.
4. To analyze whether there exist any significant relationship between various Learning Styles and Mathematics Self-Efficacy of secondary school students for the total sample.
5. To find out the influence of various Learning Styles on Mathematics Self-Efficacy of secondary school students for the total sample.

Hypotheses of the Study

The hypotheses formulated for the study are:

1. There is no significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students for the subgroup based on gender.
2. There is no significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students for the subgroup based on type of management of schools.
3. There is no significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students for the subgroup based on locale of schools.
4. There is no significant relationship between various Learning Styles and Mathematics Self-Efficacy of secondary school students.
5. There is no significant influence of various Learning Styles on Mathematics Self-Efficacy of secondary school students for the total sample.

Methodology in Brief

Method

The purpose of the present study is to investigate the influence of learning styles on mathematics self-efficacy of secondary school students. Thus, survey method was used for the study to collect necessary information.

Sample

The population considered for the present study is secondary school students in Kerala. The study was carried out on a sample of 600 secondary school students of standard VIII selected from various secondary schools of Kozhikode and Malappuram districts of Kerala state. Stratified sampling technique was used by giving due representation to strata such as gender, type of management of schools and locale of schools.

Tools used for data collection

The following tools were used for the purpose of collecting relevant information:

- Scale on Mathematics Self-Efficacy (Niranjana & Nimisha, 2019)
- Learning Style Inventory (Mumthas & Fasi, 2014)

Statistical technique to be used

For the purpose of analyzing the collected data following statistical techniques were used:

- Descriptive statistics
- Percentage analysis
- t-Test (Test the significant difference between the means of two groups)
- Pearson Product-Moment Correlation
- Analysis of Variance (ANOVA)

Scope of the Study

Mathematics is the subject which undoubtedly forms the very basis of entire world's scientific, technological and commercial system. Mathematics is useful in the development of other fields of knowledge. There is no science, no art and no profession where Mathematics does not hold a key position. Ma and Kishor (1997) propose attitude towards Mathematics as "an aggregated measure of a liking or disliking of Mathematics, a tendency to engage in or avoid mathematical activities, a belief that one is good or bad at Mathematics, and a belief that Mathematics is useful or useless".

The present study aimed to investigate the influence of Learning Style on Mathematics Self-Efficacy of secondary school students. Through the study, the existing level of mathematics self-efficacy and the learning styles preferred by secondary school students can be identified. As the study provides an evaluation on the existing level of mathematics self-efficacy of secondary school students, the results would be of great use to secondary school teachers, educationists and curriculum planners to incorporate method of teaching mathematics according to the learning styles and mathematics self-efficacy of the students. The findings of the study would help curriculum planners to make needed changes in the content of

mathematics text book and refinement of mathematics curriculum by considering the mathematics self-efficacy.

Limitations of the Study

The following limitations are identified for the present study:

- The study was conducted only on a sample of 600 secondary school students of standard VIII studying in Kozhikode and Malappuram districts of Kerala state.
- The present study was limited to the study of the influence of learning styles on Mathematics self efficacy. Review suggested that there are many other factors affecting Mathematics self efficacy of secondary school students.
- The study was conducted only on four types of learning styles suggested by Honey and Mumford.
- In the study, self reporting techniques are used to collect data from the sample, so social desirability bias may affect the study.
- In order to study the group differences, the classificatory variables selected for the study were gender, locality and type of management of the schools. The other relevant classificatory variables like level of intelligence, home environment, parental education, socio-economic status etc. were not considered.

Organization of the Report

The report of the study is presented in five chapters namely, introduction, review of related literature, methodology, analysis and interpretation and summary, findings and suggestions. The details of organization of the report are described here.

Chapter 1

This chapter of the report presents a brief introduction, need and significance of the study, statement of problem, definition of key terms, variables selected for the study, objectives of the study, hypotheses of the study, a brief description of methodology, scope and limitations of the study and organization of the report.

Chapter 2

This chapter deals with theoretical overview of the variables Learning Styles and Mathematical Self-Efficacy and also it explains the review of related studies associated with these variables.

Chapter 3

Methodology of the study was described in this chapter. It includes description of variables, objectives of the study, hypotheses, tools employed for data collection, sample drawn, data collection procedure, and statistical techniques used for analyzing the data.

Chapter 4

Details of the statistical analysis of the data along with discussion and interpretations of the results are presented in this chapter.

Chapter 5

This chapter provides a summary of study along with major findings of the study, educational implications of the study, and suggestions for further research area under consideration.

CHAPTER II
REVIEW OF RELATED LITERATURE

- Theoretical Overview of Variables
- Review of Related Studies

REVIEW OF RELATED LITERATURE

Review of related literature is an essential part of every research. A literature review is a comprehensive summary of previous research on a topic. It describes how the research is related to prior research and it shows the originality and relevance of the selected research problem. Specifically, it justifies proposed methodology. The literature review seeks to describe, summarize, evaluate, clarify and/or integrate the content of primary reports (Cooper, 1989).

The present study is an attempt to understand the influence of various Learning Styles on Mathematics Self-Efficacy of secondary school students. So this chapter consists of two major sections. The first section deals with the theoretical background of the variables and second section deals with the various studies carried out by other researchers by using the variables under consideration.

Review of related literature done for the present study is described under the following sections:

Theoretical Overview of the Variables

- Theoretical Overview of Learning Style
- Theoretical Overview of Mathematics Self-Efficacy

Review of Related Studies

- Studies on Learning Style
- Studies on Mathematics Self-Efficacy

Theoretical Overview of the Variables

Theoretical Overview of Learning Style

It is essential to understand how researchers define learning style and what is currently known about them. This section deals with meaning, and definitions of learning style and it also explains the important models of learning styles.

Meaning and Definitions of Learning Style

An individual's learning style refers to the preferential way in which the student absorbs, processes, comprehends and retains information. Every student uses a mix of learning styles. Some people may find that they have a dominant style of learning, with far less use of the other styles. Others may find that they use different styles in different circumstances. Learning styles can be defined, classified, and identified in many different ways. Few of them are described here.

Learning Styles is the composite of characteristics cognitive, affective and psychological factors that serve as relatively stable indicators of how a learner perceives, interacts with and responds to the learning environment (Keefe, 1979).

Kolb (1984) states that learning styles are relatively stable attributes or preferences or habitual strategies used by individual learner to organize and process information for problem solving.

Dunn (1984) defines learning styles as "the way in which each person absorbs and retains information and/or skills; regardless of how that process is described, it is dramatically different for each person".

Sims (1990) put forward that learning styles are typical ways a person behaves, feels, and processes information in learning situations. Therefore, learning style is demonstrated in that pattern of behavior and performance by which an individual approaches educational experience.

Stewart and Felicetti (1992) define learning styles as those "educational conditions under which a student is most likely to learn."

Dingliang defines learning styles as: "the way that a learner often adopts in the learning process, which includes the learning strategies that have been stabilized within a learner, the preference of some teaching stimuli and learning tendency." (*c.f.* Jinjin, 2014).

Reid (1995) summarizes definitions of learning styles as internally based characteristics of individuals for the intake or understanding of new information. Essentially learning styles are based upon how a person perceives and processes information to facilitate learning.

Learning Style Models

Some of the important models of learning styles such as VARK Learning Style Model, Dunn and Dunn's Learning Style Model, Kolb's Experiential Learning Model (ELM) and Honey and Mumford's learning style models are summarized here.

VARK Learning Style Model

VARK stands for visual, aural, read/write, and kinesthetic sensory modalities that are used for learning information. VARK model is one of the most popular

learning style model developed by Fleming in 1987. In this model, learners are identified by whether they have a preference for visual learning (pictures, movies, diagrams), auditory learning (music, discussion, lectures), reading and writing (making lists, reading textbooks, taking notes), or kinesthetic learning (movement, experiments, hands-on activities) (Fleming, 2001). The VARK model of learning styles suggests that there are four main types of learners. The four types of learners according to VARK model are shown in Figure 1.

*Figure 1.*VARK Model of learning styles

The various learning styles of VARK Model are

Visual (V):

This preference includes the depiction of information in maps, spider diagrams, charts, graphs, flow charts, labelled diagrams, and all the symbolic arrows, circles, hierarchies and other devices, that people use to represent what

could have been presented in words. This mode could have been called Graphic (G) as that better explains what it covers. It does not include still pictures or photographs of reality, movies, videos or PowerPoint. It does include designs, whitespace, patterns, shapes and the different formats that are used to highlight and convey information. When a whiteboard is used to draw a diagram with meaningful symbols for the relationship between different things that will be helpful for those with a visual preference. It must be more than mere words in boxes that would be helpful to those who have a read/write preference (Fleming, 2001:2017).

Aural / Auditory (A):

This perceptual mode describes a preference for information that is "heard or spoken." Learners who have this as their main preference report that they learn best from lectures, group discussion, radio, email, using mobile phones, speaking, web-chat and talking things through. Email is included here because; although it is text and could be included in the read/write category (below), it is often written in chat-style with abbreviations, colloquial terms, slang and non-formal language. The aural preference includes talking out loud as well as talking to oneself. Often people with this preference want to sort things out by speaking first, rather than sorting out their ideas and then speaking. They may say again what has already been said, or ask an obvious and previously answered question. They have need to say it themselves and they learn through saying it – their way (Fleming, 2001:2017).

Read/write (R):

This preference is for information displayed as words. Not surprisingly,

many teachers and students have a strong preference for this mode. Being able to write well and read widely are attributes sought by employers of graduates. This preference emphasizes text-based input and output – reading and writing in all its forms but especially manuals, reports, essays and assignments (Fleming, 2001). People who prefer this modality are often addicted to PowerPoint, the Internet, lists, diaries, dictionaries, thesauri, quotations and words, words, words. Note that most PowerPoint presentations and the Internet, GOOGLE and Wikipedia are essentially suited to those with this preference as there is seldom an auditory channel or a presentation that uses Visual symbols (Fleming, 2017).

Kinesthetic (K):

By definition, this modality refers to the "perceptual preference related to the use of experience and practice (simulated or real)." Although such an experience may invoke other modalities, the key is that people who prefer this mode are connected to reality, "either through concrete personal experiences, examples, practice or simulation" (Fleming & Mills, 1992). It includes demonstrations, simulations, videos and movies of "real" things, as well as case studies, practice and applications. The key is the reality or concrete nature of the example. If it can be grasped, held, tasted, or felt it will probably be included. People with this as a strong preference to learn from the experience of doing something and they value their own background of experiences and less so, the experiences of others. It is possible to write or speak kinesthetically if the topic is strongly based in reality. An assignment that requires the details of who will do what and when is suited to those with this

preference, as is a case study or a working example of what is intended or proposed (Fleming, 2017) .

Dunn and Dunn's Learning Style Model

Dunn and Dunn (1972) actively researched and developed their learning style based on over twenty years of research. According to Dunn and Dunn's theory five major factors influence one's learning style. They are 1) Environmental preferences such as class design, sound, lighting, and temperature; 2) Emotional preferences such as motivation, persistence, and responsibility; 3) Sociological preferences like learning relations (isolated & team, peer, group); 4) Psychological preferences related to perception, time, mobility; and 5) physiological processes.The learning style model developed by Dunn and Dunn(1972) is given in Figure 2.

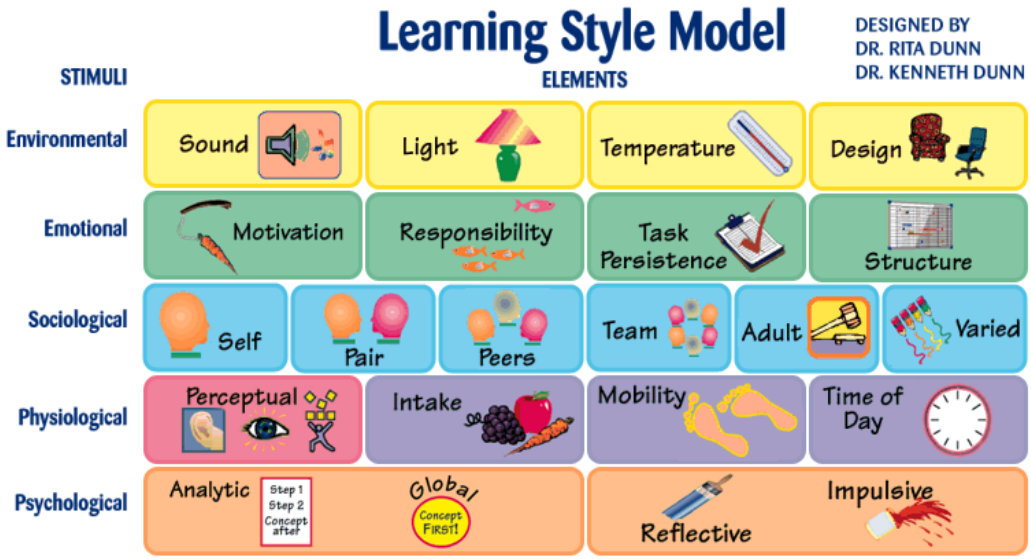

Figure 2. Dunn and Dunn's Learning Style Model

The detailed description of styles of learning in Dunn and Dunn (1972) learning style model is given here

Environmental

The first category in the Dunn and Dunn learning styles model is environmental elements. Students differ in terms of their definition of an ideal place to learn. Some wanted a warm, brightly lit place with desks, many people, and much verbal interaction, while others preferred cooler, more subdued lighting with a quieter, more informal environment. Though many teachers believe that they have little control over these elements, Dunn and Dunn (1972) describe how the standard square box of a classroom can be partitioned into separate areas with different environmental climates.

Emotional

The emotional dimension centers around the extent to which students are self-directed learners. At one end of the continuum are self-starters who can be given a long-term project and who monitor and pace themselves until finishing the job. At the other end are students who need considerable support and have their assignments in small chunks with periodic due dates. Semester-long projects without periodic checks would be disastrous with these students. Understanding your students' apparent needs for support allows you to design learning experiences that help students succeed and learn more effectively (Dunn & Dunn , 1972).

Sociological

How we interact with others plays a role in our learning styles. Working independently or working in a team, whether under supervision of an instructor or without it, may play a role in how we learn. Learning styles may also vary

depending on the specific subjects being learned. Students also differ in how they react to peer interaction. Some dislike group projects, preferring instead to learn by themselves; others thrive on the companionship and support provided by group work. Still others prefer the more traditional approach of learning from an adult (Dunn & Dunn , 1972).

Physiological

Another important dimension identified by the Dunn's (1972) relates to individual differences in terms of physiological preferences. Probably the most important element here is learning modality; some of us are visual; others prefer auditory channels. Mobility, or the ability to periodically move around, is another element here. Another important element in this dimension is time. Some of us are morning people, while others don't function fully until later in the day. Teachers accommodate this dimension when they set up learning centers that allow student movement. This dimension may be one of the hardest for teachers to accommodate (Dunn & Dunn , 1972).

Psychological

The fifth, and final learning style dimension is psychological. This dimension refers to the general strategies students use when attacking learning problems. Some attack them globally, looking at the big picture, while others prefer to address individual elements of a problem separately. In a similar way, some students jump into problems, figuring things out as they go along, while others are more reflective, planning before beginning (Dunn & Dunn, 1972).

Kolb's Experiential Learning Model (ELM)

Kolb (1984) proposed a theory of learning styles which originated out of Experiential Learning Theory. This theory works on two levels: a four-stage cycle of learning and four separate learning styles. The learning cycle basically involves four stages, namely: concrete experience, reflective observation, abstract conceptualization and active experimentation. Diagrammatic representation of four-stage cycle of learning is given in the Figure 3.

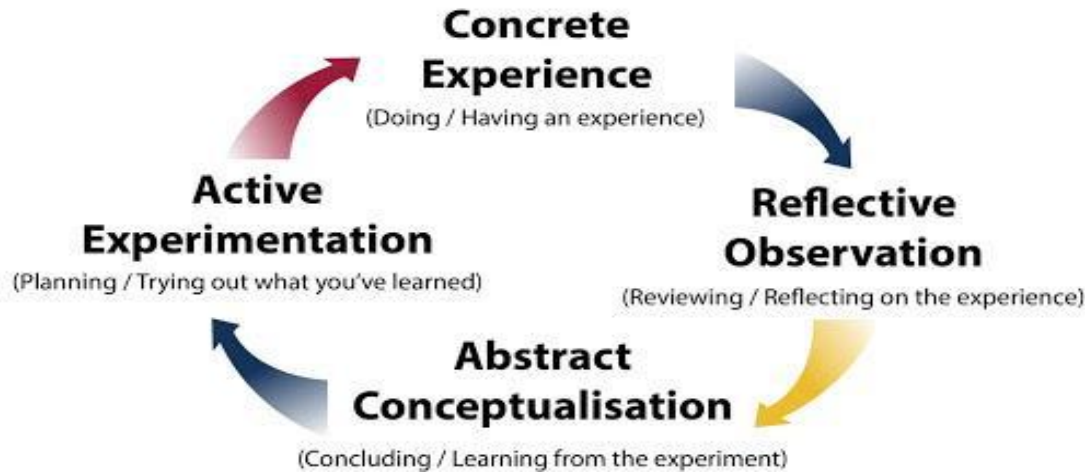

*Figure 3.*Kolb's four-stage cycle of learning

This theory identified four types of learners as Divergers, Assimilators, Convergers and Accommodators. The four distinct learning styles are based on a four-stage learning cycle. Whatever influences the choice of style, the learning style preference itself is actually the product of two pairs of variables, or two separate 'choices' that we make, which Kolb (1984) presented as lines of axis, each with 'conflicting' modes at either end: A typical presentation of Kolb's (1984) two continuums is that the east-west axis is called the Processing Continuum (how we

approach a task), and the north-south axis is called the Perception Continuum (our emotional response, or how we think or feel about it).The types of learners according to Kolb (1984) is given in Figure 4.

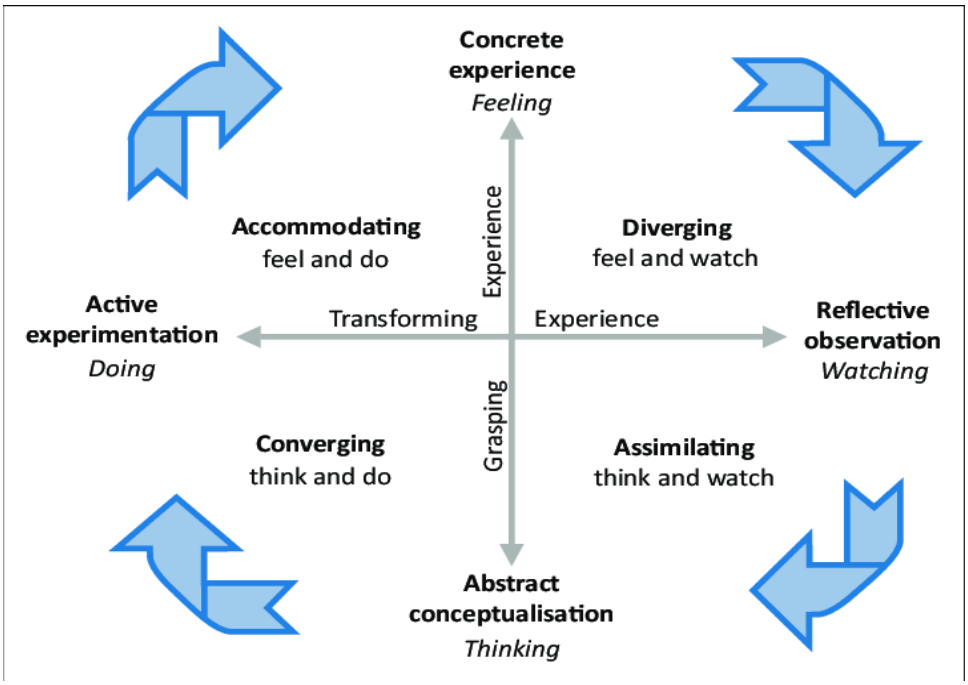

Figure 4. Kolb's four types of learners

The various types of learners according to Kolb's Model (1984) are

Divergers

These people are able to look at things from different perspectives. They are sensitive. They prefer to watch rather than do, tending to gather information and use imagination to solve problems. They are best at viewing concrete situations from several different viewpoints. Kolb (1984) called this style 'diverging' because these people perform better in situations that require ideas-generation, for example, brainstorming. People with a diverging learning style have broad cultural interests

and like to gather information. They are interested in people, tend to be imaginative and emotional, and tend to be strong in the arts. People with the diverging style prefer to work in groups, to listen with an open mind and to receive personal feedback (Kolb, 1984).

Assimilators

The assimilating learning preference involves a concise, logical approach. Ideas and concepts are more important than people. These people require a good clear explanation rather than a practical opportunity. They excel at understanding wide-ranging information and organizing it in a clear and logical format. People with an assimilating learning style are less focused on people and more interested in ideas and abstract concepts. People with this style are more attracted to logically sound theories than approaches based on practical value. This learning style is important for effectiveness in information and science careers. In formal learning situations, people with this style prefer readings, lectures, exploring analytical models, and having time to think things through (Kolb, 1984).

Convergers

People with a converging learning style can solve problems and will use their learning to find solutions to practical issues. They prefer technical tasks, and are less concerned with people and interpersonal aspects. People with a converging learning style are best at finding practical uses for ideas and theories. They can solve problems and make decisions by finding solutions to questions and problems. People with a converging learning style are more attracted to technical tasks and problems

than social or interpersonal issues. A converging learning style enables specialist and technology abilities. People with a converging style like to experiment with new ideas, to simulate, and to work with practical applications (Kolb, 1984).

Accommodators

The accommodating learning style is 'hands-on,' and relies on intuition rather than logic. These people use other people's analysis, and prefer to take a practical, experiential approach. They are attracted to new challenges and experiences, and to carrying out plans. They commonly act on 'gut' instinct rather than logical analysis. People with an accommodating learning style will tend to rely on others for information than carry out their own analysis. This learning style is prevalent within the general population (Kolb, 1984).

Honey and Mumford's Learning Style (LSQ)

Honey and Mumford (1986) identified four distinct styles or preferences that people use while learning such as Activist, Reflector, Theorist and Pragmatist. These four styles correspond approximately to those suggested by Kolb's Experiential Learning model (ELM). They suggest that most of us tend to follow only one or two of these styles, and those different learning activities may be better suited to particular styles.

Activist

Activists involve themselves fully and without bias in new experiences, they enjoy the here and now and are happy to be dominated by immediate experiences. They are open-minded, not skeptical and this tends to make them enthusiastic about

anything new. Their philosophy is “I will try anything once”. They lend themselves to act first and consider the consequences after words. Their days are filled with activity. They tackle problems by brainstorming. As soon as the excitement from one activity has died down they are busy looking for the next. They tend to thrive on the challenge of new experience but are bored with implementation and longer term consolidation. They are gregarious people constantly involving themselves with others but in doing so; they seek to centre all activists on themselves (Honey & Mumford, 1986).

Reflector

Reflectors like to stand back to ponder experiences and observe them from many different perspectives. They collect data, both first hand and from others, and prefer to think about it thoroughly before coming to a conclusion. The thorough collection and analysis of data about experiences and events is what counts so they tend to postpone reaching definitive conclusions for as long as possible. Their philosophy is to be cautious. They are thoughtful people who like to consider all possible angles and implications before making a move. They prefer to take a back seat in meetings and discussions. They enjoy observing other people in action. They listen to others and get the drift of the discussion before making their own points. They tend to adopt a low profile and have a slightly distant, tolerant unruffled air about them. When they act it is part of a wide picture which includes the past as well as the present and others ‘observations as well as their own (Honey & Mumford, 1986).

Theorist

Theorists adapt and integrate observations into complex but logically sound theories. They think problems through in a vertical, step-by step logical way. They assimilate disparate facts into coherent theories. They tend to be perfectionists who won't rest easy until things are tidy and fit into a rational scheme. They like to analyze and synthesis. They are keen on basic assumptions, principles, theories, models and systems thinking. Their philosophy is rationality and logic. " If it's logical it's good". Questions they frequently ask are: "Does it make sense?" "How does this fit with that?" "What are the basic assumptions?" They tend to be detached, analytical and dedicated to rational objectives rather than anything subjective or ambiguous. Their approach to problems is consistently logical. This is their mental set and they rigidly reject anything that doesn't fit with it. They prefer to maximize certainly and feel uncomfortable with subjective judgments, lateral thinking and anything flippant (Honey & Mumford, 1986).

Pragmatist

Pragmatists are keen on trying out ideas, theories and techniques to see if they work in practice. They positively search out new ideas and take the first opportunity to experiment with applications. They are the sorts of people who returns from management courses brimming with new ideas that they want to try out in practice. They like to get on with things and act quickly and confidently on ideas that attract them. They tend to be impatient with ruminating and open-ended discussions. They are essentially practical, down to each pile who like making practical decisions and solving problems. They respond to problems and

opportunities “as a challenge". Their philosophy is “there is always a better way” and if u work it‘s good (Honey & Mumford, 1986).

Theoretical Overview of Mathematics Self-Efficacy

A thorough review of theories of Mathematics Self-Efficacy was done by the investigator to understand the concept of Mathematics Self-Efficacy. This section deals with the meaning and sources of self-efficacy, meaning, components and measurement of Mathematics Self-Efficacy.

Meaning of Self-Efficacy

Self-efficacy is the belief is one’s ability to influence events that effect one’s life and control over the way these events are experienced (Bandura, 1994). Self-Efficacy refers to beliefs about one’s capabilities to learn or to perform behaviours at designated levels. Self-efficacy is a personal judgment of "how well one can execute courses of action required to deal with prospective situations" (Bandura,1997).

Psychologists have studied self-efficacy from several perspectives. Educator Kolbe (2009) adds, "Belief in innate abilities means valuing one's particular set of cognitive strengths. It also involves determination and perseverance to overcome obstacles that would interfere with utilizing those innate abilities to achieve goals." Self-efficacy can be thought of as part of the key competency, managing self, which is “associated with self-motivation, a ‘can-do’ attitude, and with students seeing themselves as capable learners” (Ministry of Education, 2007).

Sources of of Self-Efficacy

In social cognitive theory, Bandura (1997) suggests four sources of self-efficacy. People's beliefs about their efficacy can be developed by four main sources of influence. The various sources are mastery experiences, vicarious experience, verbal persuasion, and physiological arousal

Mastery experiences

The most effective way of creating a strong sense of efficacy is through mastery experiences. Mastery experiences are the most effective way to boost self-efficacy because people are more likely to believe they can do something new if it is similar to something they have already done well (Bandura,1994)

Vicarious experience

Another factor influencing self efficacy is vicarious experience, or the observation of the successes and failures of others(models)who are similar to one's self. The impact of modeling on perceived self-efficacy is strongly influenced by perceived similarity to the models. The greater the assumed similarity the more persuasive are the models' successes and failures. If people see the models as very different from themselves their perceived self-efficacy is not much influenced by the models' behavior and the results it produces (Bandura, 1986).

Verbal persuasion

Verbal or social persuasion is a third factor that affects self-efficacy. People who are persuaded verbally that they possess the capabilities to master given

activities are likely to mobilize greater effort and sustain it than if they harbor self-doubts and dwell on personal deficiencies when problems arise. To the extent that persuasive boosts in perceived self-efficacy lead people to try hard enough to succeed, they promote development of skills and a sense of personal efficacy. Influential people in our lives such as parents, teachers, managers or coaches can strengthen our beliefs that we have what it takes to succeed. Being persuaded that we possess the capabilities to master certain activities means that we are more likely to put in the effort and sustain it when problems arise (Bandura, 1994).

Physiological arousal

The fourth way of modifying beliefs of self-efficacy is to reduce people's stress reactions and alter their negative emotional proclivities and misinterpretations of their physical states. The physical and emotional states that occur when someone contemplates doing something provide clues as to the likelihood of success or failure. Stress, anxiety, worry, and fear all negatively affect self efficacy and can lead to a self fulfilling prophecy of failure or inability to perform the feared tasks (Pajares,2002) stressful situations create emotional arousal, which in turn affects a person's perceived self-efficacy in coping with the situation (Bundura& Adams,1977) .

The diagrammatic representation of Sources of Self-efficacy is given in Figure 5

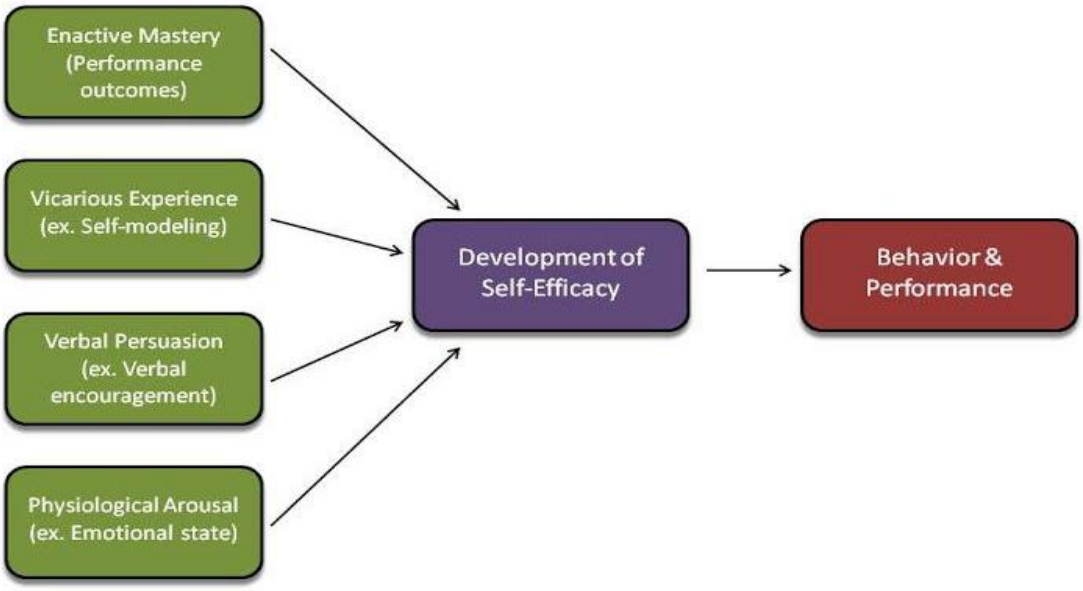

*Figure 5.*Sources of self-efficacy Bandura(1977)

Meaning and Components of Mathematics Self-Efficacy

Mathematics self-efficacy is defined as an individual's beliefs or perceptions with respect to his or her abilities in mathematics (Bandura, 1997). That is an individual's mathematics self-efficacy is his or her confidence about completing a variety of tasks, from understanding concepts to solving problems, in mathematics. Self-efficacy is specific to context and must be measured appropriately. For example, students might feel confident that they can correctly solve systems of linear equations but lack confidence in their abilities to prove a geometric theorem. In this situation, asking the students to rate their confidence in mathematics generally could result in misleading responses. Bandura (1997) also suggested that self-efficacy should be measured close to the time that the task would take place. This proximity helps students to make more accurate judgments about their abilities than otherwise. With these guidelines for measuring self-efficacy in mind, it is

crucial to understand how researchers typically measure mathematics self-efficacy (Bandura,1997).

Usher and Pajares (2009) found that “perceived mastery experience is a powerful source of students’ mathematics self-efficacy. Students who feel they have mastered skills and succeeded at challenging assignments experience a boost in their efficacy beliefs”

Hackett and Betz (1989) define mathematics self-efficacy as "a situational assessment of an individual's confidence in her or his ability to successfully perform or accomplish a particular [mathematical] task or problem”. Sometimes researchers describe people’s general confidence in their maths skill as their “maths self-efficacy”. However, we can see that maths self-efficacy is actually a belief about something more specific than maths in general. Bandura (1997) listed the information sources that shape maths self-efficacy judgments, in order of magnitude of effect. The information sources are :

- The student’s past performances—if they know they’ve successfully solved similar problems in the past, they’re likely to believe they can do this again.
- Observations of their peers—seeing students who they perceive to be similar to themselves succeed or fail will influence their own maths self-efficacy.
- Social persuasion—includes encouragement and feedback from teachers, peers, and parents especially when the student subsequently experiences success.

- Physiological and emotional cues—signs of anxiety, such as a rapid heartbeat or sweaty palms can undermine a student's belief that they can succeed at a task.

Researchers also explain some factors like teachers, students' parents and their friends can have a significant impact on a student's maths self-efficacy (Siegle & McCoach, 2007; Schunk & Hanson, 1985). The models a student observes, and the feedback received from others, shape how the student perceives his or her own abilities in maths and beyond. Students' maths self-efficacy is likely to be strengthened when:

- Students see someone like them showing the rest of the class their maths work, or explaining how they solved a problem
- Students have strategies for coping when learning is difficult, and when they make mistakes or fail
- Students know what their learning goals are, and understand what they need to do to achieve their goals
- Teachers give students feedback about the progress they are making towards their learning goals, and let them know what they need to do next to help them achieve their goals
- Teachers encourage students to reflect on the role of effort in their learning, and—when appropriate—prompt students to attribute failure to insufficient effort, and encourage them to try harder and persevere when learning is difficult

- Students' attention is drawn to the specific skills they have developed
- Students are enabled to develop internal standards for evaluating their own outcomes, rather than to rank themselves in comparison to others
- If a teacher or a parent found maths difficult when they were at school, then rather than commiserate with students, they challenge students to improve their maths, expect them to succeed, and give them the support they need to do so.

Betz and Hackett (1983) identified three main domains involved with studying mathematics self-efficacy: solving mathematics problems, using mathematics in everyday tasks, and obtaining good grades in mathematics courses. *The solving of math problems*: that is, problems similar to those found on standardized tests of mathematical aptitude and achievement. It deals with the self-confidence of a student about their ability to accomplish a maths related task or problem. *Mathematics behaviors used in everyday life*: The second domain was defined as including mathematics behaviors used in everyday life, e.g., balancing a checkbook. It represents an individual's confidence in their ability to use maths in everyday life. They believe that mathematics is important to their everyday world and they can handle real-world mathematical tasks. *Performance in college courses*: Final domain representing capability of satisfactory performance in college courses requiring various degrees of mathematics knowledge and mastery was specified..

Measuring Mathematics Self-Efficacy

By reviewing the literature in mathematics self-efficacy the investigator identified various tools used to measure mathematics self-efficacy of students at different levels. Some of the tools used to measure mathematics self-efficacy of students are described below

Researchers have not reached harmony on how to measure the sources of self-efficacy in academic settings. Most have used adapted versions of the Sources of Mathematics Self-Efficacy Scale (SMES) developed by Lent, Lopez, & Bieschke, 1991. Originally designed to assess the sources of mathematics self-efficacy of college students, the items have been adapted for use in both academic and social settings.

Bandura (1997) has provided clear guidelines regarding how self efficacy beliefs should be operationalized and measured. Because efficacy beliefs vary in level, strength, and generality, these dimensions are important in determining how instruments should be constructed. Researchers repeatedly using Bandura's (1997) four main sources of self-efficacy: mastery experiences, vicarious experiences, social persuasion, and physiological states. (Hampton & Mason, 2003; Lopez & Lent, 1992; Usher &Pajares, 2009).

Pajares and Miller (1995) also developed Mathematics Self-Efficacy Scale . This scale asked students to express their level of confidence in successfully solving each of 30 mathematics problems drawn from the eighth-grade test of the Second Study of Mathematics. Each student provided confidence judgments on each of the

30 mathematics problems. Final self-efficacy scores were the sum of confidence ratings for the 30 problems and ranged from a low of 30 to a high of 180. Both forms of the self-efficacy instrument were highly reliable: The multiple-choice and open ended versions of the instrument each produced a Cronbach's alpha coefficient of .92.

Ayotolaa and Adedejib (2009) used Mathematics Self-Efficacy Scale (MSES) and Mathematics Achievement Test (MAT) for their study. The MSES instruments asked students to express their level of confidence in successfully solving each of 25 mathematics problems drawn from MAT.

Schulz (2005) developed another tool for Mathematics Self-Efficacy. It assessed MSE through student ratings of their confidence in solving eight real-life mathematical tasks. The tasks were chosen in accordance with the PISA approach to assess mathematical literacy with test questions related to real-world problems and not with mathematical tasks derived from the curriculum. The resulting scale has an average reliability of .83 and ranged between .75 and .87.

Betz and Hackett (1983) constructed Mathematics Self-Efficacy Scale (MSES) for measuring self-efficacy in mathematics. This scale was originally developed to explore gender differences in mathematics self-efficacy and how these differences affect students' career choices. They identified three main domains involved with studying mathematics self-efficacy: solving mathematics problems, using mathematics in everyday tasks, and obtaining good grades in mathematics courses

- *The solving of math problems*: that is, problems similar to those found on standardized tests of mathematical aptitude and achievement. This approach to the assessment of attitudes toward math was utilized in Dowling's Mathematics Confidence Scale. The math problems scale of the MSES was adapted from the Mathematics Confidence Scale (MCS) created by Dowling (1978), who utilized preliminary forms in constructing her final two forms of mathematics self-efficacy and performance. Betz and Hackett (1983) selected one of the preliminary forms rather than Dowling's final instrument. Because the final version possessed stronger psychometric qualities, Betz and Hackett's scale was replaced with Dowling's problems scale. This alteration enhances both the validity of the MSES and the integrity of Dowling's original intention. Following the completion of the MSES, participants were asked to solve the 18 items of the Mathematics Problems Performance Scale (MPPS). Dowling (1978) created these items in multiple choice format to correspond to the Mathematics self-efficacy scale 7 items of the math problems self-efficacy scale. That is, they were the identical items contained in the efficacy instrument. The MSES asks participants to rate their confidence on a scale from 0 to 9 in their ability to perform 18 mathematics tasks.
- *Mathematics behaviors used in everyday life*: The second domain, similar to that represented by the Math Anxiety Rating Scale (MARS). Mathematics anxiety involves feelings of tension, discomfort, high arousal, and physiological reactivity interfering with number manipulation and mathematical problem solving. The MSES asks participants to rate their

confidence on a scale from 0 to 9 in their ability to solve 18 mathematics problems correctly (Betz & Hackett 1983).

- *Performance in college courses*: The MSES asks participants to rate their confidence on a scale from 0 to 9 in their ability to get a B or better in 16 mathematics-related college courses (Betz & Hackett 1983).

Although no factor analytic research has been conducted on the original MSES, Kranzler and Pajares (1997) used factor analytic techniques to analyze a revised version of the MSES referred to as the Mathematics Self-Efficacy Scale-Revised (MSES-R) (Pajares& Miller, 1995). The items on the MSES-R were taken from the original MSES, but the mathematical problems were replaced by problems from arithmetic, algebra, and geometry taken from the Mathematics Confidence Scale (Dowling, 1978). Also, on the MSES-R, students rated their confidence on a scale from 1 to 5, not 0 to 9 as in the original MSES. Factor analysis revealed three factors of the MSES-R, as expected: mathematical problems, mathematical tasks, and mathematics courses. The courses, however, were split into two factors—pure mathematics courses and science courses that require a lot of mathematics. The identification of multiple factors of the MSES-R suggests that mathematics self-efficacy is conceptually more complex than believed (Betz & Hackett, 1983).

Review of Related Studies

Under this section the researcher reviewed the recent studies related to Learning Styles and Mathematics Self-Efficacy. Both variables under the study were highly relevant in the current scenario of education.

Studies on Learning Style

In this section studies related with learning styles are presented in the chronological order. Rahwanda (2018) studied the impact of gender on the learning style preferences of Indonesian nursing academy students. Index of Learning Style (ILS) Questionnaire was used to collect data from 50 students. The study revealed that male students prefer to have visual/ verbal learning style than another learning style and female students prefer to have activist/ reflector learning style than another learning style. The findings provide information about learning style preferences based on gender so that teachers would be able to provide a good proportion of teaching/ learning processes. Therefore, learning styles help individuals to understand the materials better.

Ishak and Awang (2017) investigated the relationship between learning styles and student's achievement in History of 200 secondary school students in the district of Kulim, Kedah. Six different learning styles proposed by Grasha were identified and its relationship with achievement in History subject was determined. Gender is taken as the classificatory variable. The results of t-test and Pearson correlation analysis showed that there is no significant difference between learning styles based on gender and no significant relationship between learning styles and achievement of students in History.

Rahman and Ahmar (2017) examined the relationship between learning styles and learning outcomes by gender. The population in this study was all students in the first year of Senior high school in Indonesia. Test of modalities learning styles (TMLS) was used to determine whether the students' Learning styles

are visual, auditory and kinaesthetic (VAK) and documentation analysis were the instruments used in this research. The data were analyzed with the chi-square test and two-way ANOVA. The results revealed that women are dominated by the visual and auditory learning styles and there is no significant relationship between learning styles and learning outcomes by gender and no significant interaction between learning styles with learning achievement based on gender.

Ozdemir and Kaptan (2017) carried out an exploration of the learning styles of pre-service primary school teachers. Survey method was adopted for the study. Sample consisted of 1124 pre-service primary school teachers (694 females and 430 males). For determining the learning styles of the pre-service primary school teachers Kolb Learning Style Scale was used. The analysis of the data indicated that the least preferred learning style of primary teachers is described as accommodating and converging is the dominant learning styles of pre-service primary school teachers.

Nzesei (2015) conducted a study on the relationship between learning style and academic achievement among secondary school students in Kenya. Purposive sampling technique was used and the data collection instrument was the Barsch Learning Style Inventory (BLSI). This inventory identified the learning style preference among the students based on Visual (V), Auditory (A) and Kinesthetic (K) modalities. The results of the study revealed that majority of the students are trimodal learners, followed by bimodal (VA) learners and thirdly by uni-modal (V) learners and the least preferred learning style is the single kinesthetic modality which was preferred by only 2 female students. Results also indicated that the

learning style preferences do not differ according to the gender and high and low academic achievement groups. Learning styles and academic achievement showed a strong, positive relationship for the tri modal learners, and among male and female students

Thomas (2014) investigated the effectiveness of co-operative learning on learning styles and academic performance in mathematics of the upper primary students of Kerala. Experimental method consisting of both quantitative and qualitative methodology was adopted. For the purpose of the study, the students were categorized into four groups of learning styles, viz., pragmatists, activists, reflectors and theorists. The quantitative analysis of the data collected was done using t-test and ANCOVA revealed that achievement in mathematics of a pupil at upper primary level depends on the learning style of that pupil and that the performance of pupils in mathematics can be enhanced through the select co-operative learning pattern. The findings of the study helped the teachers to match the learning task with the learning styles of students and design mathematics curriculum accordingly.

Fasi (2014) conducted a comparative study of learning styles and academic achievement of boarders and day scholars in social science. The results indicated that learning style of secondary school students significantly influences the academic achievement. The results also showed that those students who are following the reflector style of learning have high achievement.

Sahoo and Chandra (2013) conducted a study to investigate the learning styles of Open-Distance mode (ODL) B.Ed students of the Indira Gandhi National

Open University (IGNOU).This study also examined the relationship between different learning styles and response patterns of B.Ed students of IGNOU. Descriptive survey method was used in this study. Grasha-Reichmann Learning Style Scale was used to determine the learning style of learners. Sample consisted of 150 final year B.Ed. trainees of IGNOU enrolled in UP. The results of the study reported that a large majority of students of ODL mode were found to be adopting collaborative, participant, dependent, and competitive learning styles. The response patterns of B.Ed. trainees and learning styles were found associated with each other. Students having independent learning style were found to be significantly larger in numbers than those having dependent style while the numbers of students with participant learning style were found to be significantly larger than those having avoidant style among distance mode B.Ed. trainees. The number of students having a collaborative style was found to be approximately the same as students with competitive learning style.

Wilkinson, Boohan and Stevenson (2013) conducted a study to understand the influence of leaning styles on the first year medical and dental students' performance in various subject areas. Correlation analyses revealed that in most subject cases there relation with learning styles and performance of students in single best answer, short answer questions and objective structured clinical examinations was not significant. The results also indicated that theorist learning style influences more significantly on the overall performance of medical students than pragmatist, reflector and activist learning styles.

Caliskan and Kilinic (2012) examined the relationship between learning style

and the attitude towards social studies course. The study was conducted on a sample of 320 primary school students. Measuring instruments used for the study was Perceptual Learning Style Preference Survey and Attitude Scale for Social Studies course . Results of the study indicated that there is positive, moderate relationship was found between learning style and attitude toward Social Science course. In addition there existed a significant difference in auditory; kinaesthetic and tactile learning style preferences on the basis of class level, but there is no significant difference in other preferred learning styles.

Jilardidamavandi, Mahyuddin, Elias, Daud, &Shabani (2011) investigated the impact of learning styles on the academic achievement of secondary school students in Iran. The Kolb Learning Style Inventory was administered in eight public schools in Tehran. The mean of test scores in five subjects, namely English, Science, Mathematics, History and Geography was calculated for each student and used as a measure of academic achievement. A total of 285 Grade 10 students were randomly selected as sample of this study. The results of the analyses of variance showed that there is a statistically significant difference in the academic achievement of the Iranian students that correspond to the four Learning Styles [$F(3, 285) = 9.52$, $p < .05$]; in particular, the mean scores for the converging and assimilating groups are significantly higher than for the diverging and accommodating groups.

Moenikia aand Babelan (2010) investigated the role of learning styles in second language learning among distance education students. Sample consisted of 112 students chosen randomly from Ardabil Payame Noor University English language students. Findings showed that the listening, writing, structure and reading mean scores of students with different learning styles are significantly different.

Studies on Mathematics Self-Efficacy

In this section studies related with Mathematics self-efficacy are presented in the chronological order. Kahramanogluand Deniz (2017) designed a correlational study to examine the relationship between middle school students' metacognitive skills, mathematics self-efficacy, and mathematics achievement. The sample for the study consisted of 190 middle school 7th grade students. The data were collected by using the Metacognitive Skills Scale and Resources of Self-Efficacy Scale. The results of the study revealed that there exist no significant difference was detected between VII grade students' mathematics scores in terms of gender variable. When the relationship between the variables was examined, it was revealed that there was a positive and high-level relationship between mathematics self-efficacy and mathematics achievement; however, a positive but low-level relationship was found between metacognitive skills and mathematics achievement.

Zarei, Esfandiari and Hosseini (2016) identified that language learning styles and strategies as predictors of computer use anxiety and computer self-efficacy. Computer-based instruction has been prevalent in most learning environments over the past few decades; however, some students may still be reluctant to use them due to the apprehension and fear computers bring with themselves. This fear and apprehension in the use of computers may pose learners problems on their future encounter with computers. Anxiety in employing computers is of interest to researchers because of the inverse effect it has on computer self-efficacy. The more anxious students feel in using computers, the less self-efficient they become in accomplishing a task. Empirical analysis indicated that learning styles and strategies as predictors of computer use anxiety and computer self-efficacy.

Perez and Ye (2013) examined the relation between mathematics self-efficacy and mathematics achievement of Mathayomsuksa students in the English program of St. Joseph Bangna School. The study focused on 198 Mathayomsuksa 1 to 3 students of the English program enrolled in the academic year 2012-2013. The students sample answered mathematics self-efficacy questionnaires to rate their confidence in being able to solve math problems that they had already learned. The students' test scores in mathematics in the final examination were the basis of mathematics achievement in this study. The results revealed that there exists a significant relationship between students' self-efficacy and achievement.

Ayotolaa and Adedejib (2009) examined the relationship between mathematics self-efficacy and achievement in Mathematics. Data was collected from 352 senior secondary students in Oyo State. The study revealed that there is no significant difference obtained between male and female students in Mathematics Self-Efficacy and Mathematics achievement. The researcher recommends that teachers should find ways of enhancing Mathematics Self- Efficacy among students and should place emphasis on student's confidence to succeed in Mathematics achievement.

West, Kahn, and Nauta (2007) studied the relation between learning style and research self-efficacy. The results showed that students with more active (vs. reflective) and more intuitive (vs. sensing) learning styles reported greater research self-efficacy, and students with more intuitive (vs. sensing) and more verbal (vs. visual) learning styles reported greater research interest.

Warwick (2006) designed a pilot study to investigate differences in mathematical self-efficacy for two groups of students taking a general mathematics unit as part of their first year computing and IT undergraduate studies. It further investigated two linear programming models to see whether mathematical self-efficacy scores can be used to indicate an appropriate choice of course for certain students on application to university. The results of the survey revealed differences to mathematical self-efficacy between the groups and suggest that a larger study may yield benefits in the selection of students for courses and also the way mathematical material is taught.

Kabiri and Kiamanesh (2004) investigated the role of personal variables such as math self-efficacy, math attitude mathematics anxiety and prior math achievement on students' math achievement using a causal path analytic model and to identify the direct and indirect effects of these variables on each other. Path analysis was utilized for analyzing the data. The sample for the study consisted of 366 Iranian eighth grade students and the data were collected by using Pajares' Questionnaire, Shokrani's Questionnaire, the revised edition of Fennema's Questionnaire and the students' mathematics score in the previous academic year. The results indicated that prior math achievement and mathematics self-efficacy played the most important role in students' mathematics achievement, respectively. Furthermore, the mediator role of self-efficacy between math achievement and math attitude was confirmed. Math anxiety mediates the role of math self-efficacy and mathematics attitude on the one hand and the role of math achievement on the other hand. The results also showed that previous math achievement has strong direct and

indirect effects on students' mathematics achievement through math attitudes, mathematics self-efficacy and math anxiety. Math attitude has an outstanding effect on math anxiety. The direct and indirect effects of math attitude revealed that this variable passes its effect on math achievement through mediator variables such as self-efficacy and math anxiety.

Pajares and Miller (1997) conducted a study to determine whether varying the assessment format would influence students' self-efficacy judgments or alter the relationship between self-efficacy and performance. For this purpose, mathematics self-efficacy and problem-solving performance of 327 middle-school students were assessed using two forms of assessment (traditional multiple-choice vs. open-ended fill-in-the-blank). No differences in self-efficacy resulted from the different forms of assessment. Students who took the multiple-choice performance test obtained higher scores than did students who took the open-ended test. Findings also suggested that students' self-perceptions of their mathematics capability may be less accurate than has previously been reported or that students' familiarity with traditional assessment formats creates an expectancy of a performance task that is multiple choice in nature; this expectancy influences self-efficacy judgments regardless of the format used to assess confidence. Differences in the format for assessing self-efficacy and performance altered the predictive utility of self-efficacy judgments.

Randhawa, Beamer and Lundberg (1993) investigated the role of mathematics self-efficacy in mathematics achievement using structural equation modeling. Mathematics Self-efficacy Scale (MSES) was used to measure students’ confidence level in completing mathematics courses, solving mathematics problems,

and dealing with everyday mathematics-related tasks. Results indicated that mathematics attitude had both direct and indirect effects on mathematics achievement, but self-efficacy was a mediator variable between mathematics attitude and mathematics achievement.

Multon, Brown and Lent (1991) investigated meta-analytically the relation of self-efficacy beliefs to academic performance and persistence. Results revealed positive and statistically significant relationships between self-efficacy beliefs and academic performance and persistence outcomes across a wide variety of subjects, experimental designs, and assessment methods. The relationships were found to be heterogeneous across studies, and the variance in reported effect sizes was partially explained by certain study characteristics.

Betz and Hackett (1983) investigated the relationship of mathematics self-efficacy expectations to the selection of science-based majors in college males and females. Based on results obtained from a pilot sample of college students, an instrument assessing mathematics self-efficacy expectations was developed. The items used in the mathematics self-efficacy scale included everyday math tasks, math problems, and math-based college courses. Sample of 153 female and 109 male undergraduates, completed the mathematics self-efficacy scale, the Bern Sex Role Inventory, an adapted version of the Fennema-Sherman Mathematics Attitudes Scales, and a questionnaire concerning their college major choices. Results indicated that mathematics self-efficacy expectations were significantly related to the extent to which students selected science-based college majors, thus supporting the postulated role of cognitive mediational factors in educational and career choice behavior. In

addition, the math-related self-efficacy expectations of college males were significantly stronger than were those of college females.

Conclusion

An intense search of related studies magnified that a series of studies are conducted on variables namely Learning Styles and Mathematics Self-Efficacy. The studies which are highly relevant and suitable to the present context are only presented in the review of literature. It is evident that most of the research studies in learning styles are done outside the country. The review of related studies revealed that learning styles have a prominent role in students' achievement and gender can influence the learning style preference of the students.

The analysis of research studies reported in students' self-efficacy indicates that self-efficacy play a significant role in academic performance and learning process. Most of the research studies in Mathematics self-efficacy are done outside the country. The review of related studies recommends that teachers should find ways of enhancing Mathematics Self- Efficacy in students and should place emphasis on student's confidence to succeed in Mathematics achievement. While conducting the review it was also noted that among the various factors, researches showed that learning style influences the self-efficacy in particular task across the domains. At the same time no studies were found that analyzes the influence of Learning Styles on mathematics Self-Efficacy of secondary school students. Thus, it would be worthwhile to understand the Influence of Learning Styles on Mathematics Self-Efficacy of Secondary School Students.

CHAPTER III
METHODOLOGY

- Variables of the Study
- Objectives of the Study
- Hypotheses of the Study
- Method Used
- Sample Selected for the Study
- Tools Used for Data Collection
- Data Collection Procedure
- Statistical Techniques Used

METHODOLOGY

This chapter explains the specific procedures or techniques used to identify, select, collect, process and analyze the information related to the study. It describes the method adopted for the study, tools used for data collection, and the statistical techniques used for collecting and analyzing the required data. The present study entitled **INFLUENCE OF LEARNING STYLES ON MATHEMATICS SELF-EFFICACY OF SECONDARY SCHOOL STUDENTS** attempts to find out the influence of independent variable, Learning Styles on the dependent variable, Mathematics Self-Efficacy, of secondary school students.

The methodology adopted for the present study is described under the following headings.

- Variables of the Study
- Objectives of the Study
- Hypotheses of the Study
- Method Used
- Sample Selected for the Study
- Tools Used for Data Collection
- Data Collection Procedure
- Statistical Techniques Used

Variables of the Study

The variables used for the study are:

- *Independent Variable:* Learning Styles
- *Dependent Variable:* Mathematics Self-Efficacy

Objectives of the Study

The objectives of the study are:

1. To identify the type of Learning Style preferred by the secondary school students for total sample and subgroups based on gender, type of management of schools and locale of schools.
2. To find out the extent of Mathematics Self-Efficacy of secondary school students
3. To analyze whether there exist any significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students for the subgroups based on gender, type of management of schools and locale of schools
4. To analyze whether there exist any significant relationship between various Learning Styles and Mathematics Self-Efficacy of secondary school students for the total sample
5. To find out the influence of various Learning Styles on Mathematics Self-Efficacy of secondary school students for the total sample.

Hypotheses of the Study

The hypotheses formulated for the study are:

1. There is no significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students for the subgroup based on gender.
2. There is no significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students for the subgroup based on type of management of schools.
3. There is no significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students for the subgroup based on locale of schools.
4. There is no significant relationship between various Learning Styles and Mathematics Self-Efficacy of secondary school students.
5. There is no significant influence of various Learning Styles on Mathematics Self-Efficacy of secondary school students for the total sample.

Method Used

Survey method was used to collect necessary data as the purpose of the study is to investigate the influence of Learning Styles on Mathematics Self-Efficacy of secondary school students.

Tools used for Data Collection

The required data was collected by using two tools. One is adopted and the other is constructed and standardized by the investigator with the help of the supervising teacher. The tools used for the present study are:

- Scale on Mathematics Self-Efficacy (Niranjana & Nimisha, 2019)
- Learning Style Inventory (Mumthas & Fasi, 2014)

The tools used for collecting data are described in detail under this section.

Scale on Mathematics Self-Efficacy (Niranjana & Nimisha, 2019)

For measuring the Mathematics Self-Efficacy of secondary school students, a Scale on Mathematics Self-Efficacy was constructed and standardized by the investigator with the help of the supervising teacher.

Planning of the Scale

Planning of the scale is the first step in the construction of a scale. It is essential to understand how researchers define Mathematics Self-Efficacy and what is currently known about them to identify the dimensions of Scale on Mathematics Self-Efficacy. After reviewing the literature on Mathematics Self-Efficacy, the investigator decided to use Scale on Mathematics Self-Efficacy as the construct is a personal attribute. The Scale on Mathematics Self-Efficacy is constructed on the basis of the three dimensions of Mathematics Self-Efficacy such as solving of math problems, mathematics behaviors used in everyday life and performance in courses (Betz & Hackett, 1983). The investigator used a five point scale in which responders

specify their level of agreement to a statement typically in five points such as (1) Strongly agree; (2) Agree; (3) Neither agree nor disagree; (4) Disagree; (5) Strongly disagree to measure Mathematics Self-Efficacy of secondary school students.

Preparation of the Scale

The Scale on Mathematics Self-Efficacy was prepared on the basis of dimensions suggested by Betz& Hackett (1983). The various dimensions of Scale on Mathematics Self-Efficacy identified are:

- Solving of math problems
- Mathematics behaviors used in everyday life
- Performance in courses

The details of the dimensions are described below:

S***olving of math problems***

This dimension represents self-confidence of a student about their ability to accomplish a maths related task or problem. They believe that they can solve a math problem and they enjoy doing it. This dimension includes 17 items in Scale of Mathematics Self- Efficacy

Eg: I like to solve difficult mathematics problems

Mathematics behaviors used in everyday life

The second dimension, mathematics behaviors used in everyday life, represents an individual's confidence in their ability to use maths in everyday life.

They believe that mathematics is important to their everyday world and they can handle real-world mathematical tasks. The Scale on Mathematics Self-Efficacy consists of 14 items under this dimension.

Eg: I have confidence in winning Maths related games

Performance in courses

Final dimension, performance in courses, represents capability of satisfactory performance in school subject requiring various degrees of mathematics knowledge and mastery was specified. Capability of satisfactory performance in school courses requiring various degrees of mathematics knowledge and mastery. The Scale on Mathematics Self-Efficacy consists of 12 items under this dimension.

Eg: I have special interests in Mathematics projects.

The investigator developed the Scale on Mathematic Self-Efficacy on the basis of above mentioned dimensions. The draft Scale on Mathematics Self-Efficacy consists of 43 items. The draft Scale on Mathematics Self-Efficacy is given in Appendix 1. The dimension-wise distribution of items in Scale on Mathematics Self-Efficacy is presented in the Table 1.

Table 1

Dimension-wise Distribution of Items in Scale on Mathematics Self-Efficacy

Sl. No.	Dimensions of Mathematics Self Efficacy	Item Numbers
1	Solving of math problems	1,2,8,11,13,14,15,19,22,23,26,27,28, 31,34,36,38
2	Mathematics behaviors used in everyday life	3,4,5,6,7,9,10,12,16,29,32,39,41,43
3	Performance in college courses	17,18,20,21,24,25,30,33,35,37,40,42

Scoring Procedure

The Scale on Mathematics Self-Efficacy consisted of items that can be answered with the responses Strongly Agree (SA), Agree (A), Neither agree nor disagree (U), Disagree (D) and Strongly Disagree (D). The respondent has to mark their responses to each item in the appropriate columns corresponding to any five alternatives. The positive items are scored by giving a score of 5 for Strongly agree, 4 for Agree, 3 for Neither agree nor disagree, 2 for Disagree and 1 for Strongly Disagree. The reverse scoring procedure was adopted for the negative items. The draft Scale on Mathematics Self-Efficacy consists of 23 positive items and 20 negative items. The total score obtained for each sample is calculated to identify the score of Mathematics Self-Efficacy of secondary school students.

Pilot Testing

A sample of 370 secondary school students of standard VIII was selected for pilot testing. Due representation was given to the sub groups of the population while

selecting the sample for pilot testing. The draft Scale on Mathematics Self-Efficacy prepared was administered to the selected sample. Before administering the tool, necessary instructions were given to the students. The response sheets of 370 students that are complete in all respects were selected for item analysis. The scores obtained in the pilot testing were subjected to item analysis.

Item Analysis

Item analysis was carried out to ensure the quality of items and for selecting items of the final Scale on Mathematics Self-Efficacy. The selection of items for the final Scale on Mathematics Self-Efficacy was done as per the procedure suggested by Edwards (1969). The scores obtained for 370 students after pilot testing were arranged in the descending order. The upper 27 percent and lower 27 percent of scores were identified and separated as upper group and lower group respectively. The scores obtained for each item by the upper group as well as the lower groups were calculated separately. The t value was calculated by using the formula:

$$t = \frac{\overline{\mathrm{X_H}} - \overline{\mathrm{X_L}}}{\sqrt{\frac{S^2{}_H}{n_H} + \frac{S^2{}_L}{n_L}}}$$

Where,

$\overline{X_H}$ = The Mean score on a given statement for the high group

$\overline{X_L}$ = The Mean score on a given statement for the low group

$S^2{}_H$ = The variance of the distribution of responses of the high group to the statement

$S^2{}_L$ = The variance of the distribution of responses of the low group to the statement

n_H = The number of subjects in the high group

n_L = The number of subjects in the low group

The result of item analysis of Scale on Mathematics Self-Efficacy is given in the Table 2.

Table 2

Result of Item Analysis of Items in Scale on Mathematics Self-Efficacy

Sl. No.	t-value	Status	Sl. No.	t-value	Status
1	3.516	Accepted	23	3.971	Accepted
2	4.239	Accepted	24	5.344	Accepted
3	5.007	Accepted	25	2.654	Accepted
4	3.808	Accepted	26	2.156	Rejected
5	4.508	Accepted	27	5.024	Accepted
6	2.656	Accepted	28	2.884	Accepted
7	4.239	Accepted	29	5.267	Accepted
8	3.558	Accepted	30	3.108	Accepted
9	3.248	Accepted	31	4.969	Accepted
10	2.536	Rejected	32	4.594	Accepted
11	8.375	Accepted	33	.639	Rejected
12	3.037	Accepted	34	5.412	Accepted
13	5.000	Accepted	35	2.178	Rejected
14	4.953	Accepted	36	2.993	Accepted
15	4.932	Accepted	37	3.334	Accepted
16	5.056	Accepted	38	5.221	Accepted
17	4.706	Accepted	39	3.341	Accepted
18	3.228	Accepted	40	2.741	Accepted
19	4.267	Accepted	41	3.723	Accepted
20	5.080	Accepted	42	3.093	Accepted
21	3.543	Accepted	43	3.790	Accepted
22	3.400	Accepted			

Statements with t value greater than or equal to 2.58 were selected for the final version of Scale on Mathematics Self-Efficacy. Therefore, the final version of Scale on Mathematics Self-Efficacy consists of 39 items. The final version of the Scale on Mathematics Self-Efficacy (Malayalam and English) and its response sheet are presented in Appendix II. III and IV

Validity and Reliability

The validity of the Scale on Mathematics Self-Efficacy is ensured through face validity and content validity by consulting with experts in the field of education and mathematics education. The reliability of Scale on Mathematics Self-Efficacy was established by using the test re-test method. The Scale on Mathematics Self-Efficacy was re-administered to the same sample after three weeks time. Pearson's product moment coefficient of correlation is calculated for the two sets of scores to obtain the reliability of the scale. The reliability coefficient obtained is 0.72 (N=40). The Index suggests that the scale is reliable. The reliability of the Scale on Mathematics Self-Efficacy is also established by using Cronbach's alpha. The Cronbach alpha coefficient obtained is 0.815 which ensured the reliability of Scale on Mathematics Self-Efficacy.

Learning Style Inventory

For measuring Learning Style preferences of secondary school students, the investigator adopted Learning Style Inventory (Mumthas & Fasi, 2014). The Learning Style Inventory was used to assess an individual’s preferences and needs regarding the learning process. The inventory was based on Honey and Mumford

Learning Style Model. In their study they advocated four major styles, viz., ‘Activist’, ‘Reflector’, ‘Theorist’ and ‘Pragmatist’.

Description of each of these components given by the developers of the tool is described here.

Activist

Activists like to be involved in new experiences. They are open minded and enthusiastic about new ideas but get bored with implementation. They enjoy doing things and tend to act first and consider the implication after words. They like working with others but tend to hog the limelight. They tend to act first and consider the consequences after words.

Eg: I respond to anything spontaneously.

Reflector

Reflectors like to stand back and look at a situation from different perspectives. They like to collect data and think about it carefully before coming to any conclusions. They enjoy observing others and will listen to their views before offering their own. They are thoughtful people who like to consider all possible angles and implications before making a move.

Eg: I think several times before I take a decision.

Theorist

Theorists adapt and integrate observations into complex and logically sound theories. They think problems through in a step by step way. They tend to be

perfectionists who like fit things into a rational scheme. They tend to be detached and analytical rather than subjective or emotive in their thinking. They think problems through in a vertical, step-by step logical way.

Eg: I deal the problems in a logical way.

Pragmatist

Pragmatists are keen to try things out they want concepts that can be applied to their job. They tend to be impatient with lengthy discussions and are practical and down to earth. They positively search out new ideas and take the first opportunity to experiment with applications. They like to get on with things and act quickly and confidently on ideas that attract them.

Eg: I learn through activities.

Scoring Procedure

In this Learning Style Inventory the respondent has the freedom to choose their response as either ‘agree’ or ‘disagree’ for each item. A score of ‘1’ is given to the response ‘agree’ and ‘0’ is given to response ‘disagree’. For each category of Learning Styles, total score is found out. Thus an individual got four separate scores for each Learning Styles. Learning Style preference is found out by comparing the scores obtained for each category. The learning style with highest score is treated as the preferred style of each student.

Validity and Reliability

The developers of the tool ensured the validity of the Learning Style Inventory by using face validity. The reliability of the Learning Style Inventory was ensured by using Cronbach alpha. The value of Cronbach alpha for the items is 0.60.The value indicates that the inventory is reliable to measure Learning Style of secondary school students. Learning Style Inventory is given in Appendix V and VI.

Sample Selected for the Study

The population considered for the study is secondary school students in Kerala state. The study was carried out on a sample of 600 secondary school students of standard VIII selected from various secondary schools of Kozhikode and Malappuram districts of Kerala state. Stratified sampling technique was used by giving due representation to strata such as gender, type of management of schools and locale of schools. While selecting the sample, a ratio of 1:1 for gender, 1:1 for locale and 7:14:9 for type of management were considered. The breakup of the final sample is given in the Figure 6.

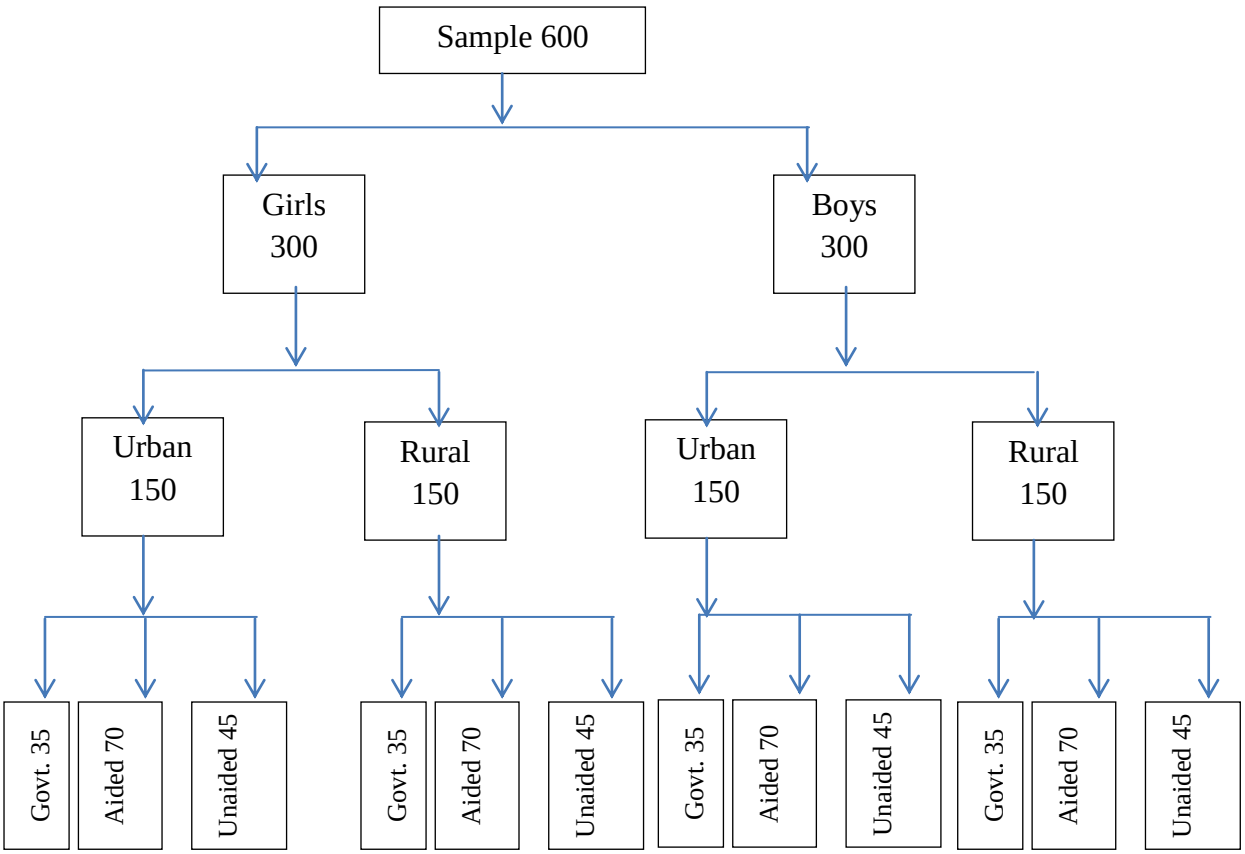

Figure 6 : Break up of final sample

Data Collection Procedure

The data required for the study was collected from the selected sample,i.e.600 secondary school students of standard VIII from Kozhikode and Malppuram districts of Kerala state.. At first, the researcher sought permission from various heads of selected secondary schools of Kozhikode and Malappuram districts of Kerala State. After getting the permission from the Head Master/ Head Mistress, the researcher administered the Scale on Mathematics Self-Efficacy and Learning Style Inventory to secondary school students of standard VIII by providing necessary instruction to the students to fill the response sheet. First of all the Learning Style Inventory was administered in 30 minutes. After that Scale on

Mathematics Self-Efficacy was administered for a period of 30 minutes. Altogether the investigator took almost one hour to administer the two tools. The filled response sheets were collected and response sheets of both the tools which are complete in all aspects were considered for data analysis.

Statistical Techniques Used

For the purpose of analyzing the collected data following statistical techniques were used:

- Descriptive statistics
- Percentage analysis
- t-Test (Test the significant difference between the means of two groups)
- Pearson Product-Moment Correlation
- Analysis of Variance (ANOVA)

Descriptive Statistics

To know the basic properties of the variables mean, median, mode, standard deviation, skewness and kurtosis was calculated to the dependent and independent variables such as Learning Styles and Mathematics Self-Efficacy of secondary school students.

Percentage Analysis

Percentage analysis is widely used to interpret primary data. For the present study, percentage analysis is used to identify the Learning Style preferred by secondary school students for the total sample and subgroups based on gender, type

of management and locale of schools. It is also used to find out the extent of Mathematics Self-Efficacy of secondary school students for total sample.

t-Test (Test the significant difference between the means of two groups)

The Test of significance of the difference between means of large independent sample (*t*-test) was used to know whether there exist significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students with respect to gender and locale of schools.

The t value can be calculated using the formulae;

$$t = \frac{(X_1 - X_2)}{\sqrt{\frac{(s_1)^2}{n_1} + \frac{(s_2)^2}{n_2}}}$$

Where,

X_1 = Mean of the upper group

X_2 = Mean of the upper group

s_1 = standard deviation of the upper group

s_2 = standard deviation of the lower group

n_1 = Sample size of the upper group

n_2 = Sample size of the lower group

Pearson Product-Moment Correlation

The Pearson product-moment correlation coefficient (or Pearson correlation coefficient,) is a measure of the strength of a linear association between two variables and is denoted by r. Basically, Pearson product-moment correlation

attempts to draw a line of best fit through the data of two variables, and the Pearson correlation coefficient, r, indicates how far away all these data points are to this line of best fit. For the present study, the Pearson's product moment correlation used to find relationship between various Learning Styles and Mathematics Self-Efficacy of secondary school students.

The formula used to find the product moment correlation is:

$$r = \frac{N(\sum XY) - (\sum X)(\sum Y)}{\sqrt{[N\sum X^2 - (\sum X)^2][N\sum Y^2 - (\sum Y)^2]}}$$

$\sum$X =Total score for first set of scores

$\sum$Y = Total score for second set of scores

N= Number of students

Analysis of Variance (ANOVA)

One way analysis of variance was carried out to know whether there exists significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students for the subgroups based on type of management of schools.

One-way analysis of variance was also carried out to know the influence of independent variable, Learning Styles i.e. Activist, Theorist, Pragmatist and Reflector, on the dependent variable, Mathematics Self-Efficacy of secondary school students.

CHAPTER IV

ANALYSIS AND INTERPRETATION

- Preliminary Analysis
- Major Analysis

ANALYSIS AND INTERPRETATION

The present study was designed to find out the influence of Learning Styles on Mathematics Self-Efficacy of secondary school students. Basic descriptive statistics, Pearson's product-moment correlation, percentage analysis, *t*-test (test the significant difference between the means of two large independent sample), Analysis of Variance (ANOVA) were carried out for the purpose of analyzing collected data.

The analysis chapter of the present study is carried out in two phases i.e., preliminary analysis and major analysis. The preliminary analysis deals with the relevant statistical constants such as Mean, Median, Mode, Standard Deviation, Skewness and Kurtosis for identifying the nature of distributions of independent variable, Learning Styles and dependent variable, Mathematics Self-Efficacy, selected for the study. Preliminary analysis was carried out to understand the properties of distribution of scores of the independent and dependent variables The major analysis deals with the results of major statistical techniques such as percentage analysis, mean difference analysis and analysis of variance. The percentage analysis is used to find out the learning style preferred by secondary school students for the total sample and subgroups based on gender, type of management and locale of schools. Percentage analysis is also used to find out the extent of mathematics self-efficacy of secondary school students for total sample. Mean difference analysis is carried out for investigating the significant difference in the mean scores of dependent variable, Mathematics Self-Efficacy, based on gender, locale and type of management of the schools. The one-way analysis of

variance is carried out to understand the influence of Learning Styles on Mathematics Self-Efficacy of secondary school students. The statistical analysis was done on the background of the objectives formulated for the study.

The results of the whole analysis done in the present study are described under the following heads:

- Preliminary Analysis
- Major Analysis
  - Percentage Analysis
  - Mean Difference Analysis
  - Correlation Analysis
- Analysis of Variance

Based on the results of statistical processing of data, the investigator tested the hypotheses formulated for the study.

Objectives of the Study

The objectives of the study are:

1. To identify the type of Learning Style preferred by the secondary school students for total sample and subgroups based on gender, type of management of schools and locale of schools.
2. To find out the extent of Mathematics Self-Efficacy of secondary school students.

3. To analyze whether there exist any significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students for the subgroups based on gender, type of management of schools and locale of schools.
4. To analyze whether there exist any significant relationship between various Learning Styles and Mathematics Self-Efficacy of secondary school students for the total sample.
5. To find out the influence of various Learning Styles on Mathematics Self-Efficacy of secondary school students for the total sample.

Hypotheses of the Study

The hypotheses formulated for the study are:

1. There is no significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students for the subgroup based on gender.
2. There is no significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students for the subgroup based on type of management of schools.
3. There is no significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students for the subgroup based on locale of schools.
4. There is no significant relationship between various Learning Styles and Mathematics Self-Efficacy of secondary school students.
5. There is no significant influence of various Learning Styles on Mathematics Self-Efficacy of secondary school students for the total sample.

Preliminary Analysis

As the first step of analysis, to know the basic properties of the variables, preliminary analysis of the scores of independent variable, Learning Style and dependent variable, Mathematics Self-Efficacy, was carried out for the total sample. Preliminary analysis helped the investigator to understand the basic properties of the distribution of scores of variables under study. It gives a concise summary of the collected data which can be used to make more valid interpretations of the results for the present study. The distribution of scores of independent variable, Learning Styles, and the dependent variable, Mathematics Self-Efficacy were studied to understand whether the distribution follows normality. The important statistical constants such as mean, median, mode, standard deviation, skewness, and kurtosis of the distribution of scores for learning styles on Mathematics Self-Efficacy were determined for the total sample.

The results of descriptive statistics for the distribution of scores of Learning Styles of secondary school students are calculated. Important statistical constants for the distribution of scores of Learning Styles (Activist, Theorist, Pragmatist, and Reflector) of secondary school students for the total sample are calculated and presented in Table 3.

Table 3

Descriptive Statistics of the Variable Learning Styles of Secondary School Students for the Total Sample

Learning Styles	N	Mean	Median	Mode	SD	Skewness	Kurtosis
Activist	68	5.05	5.00	5	1.901	-.027	.199
Theorist	228	6.53	7.00	6	1.726	-.214	-.643
Pragmatist	70	5.66	6.00	7	1.807	-.461	.029
Reflector	234	6.70	7.00	8	1.704	-.379	-.440

Table 3 points that the Mean (5.05), Median (5.00), and Mode (5.00) of Activist Learning Style of Secondary School Students coincide approximately. The Standard Deviation (1.901) indicates that the scores of Activist Learning Style do not deviate much from the mean. The indices of Skewness (-0.27) and Kurtosis (0.199) indicate that the distribution is slightly negatively skewed, and slightly leptokurtic in nature for scores of Activist Learning Style of Secondary School Students. Thus, the distribution of the scores of Activist Learning style of secondary school students shows that the distribution is almost normal.

The graphical representation of the distribution of scores of Activist Learning style is given in Figure 7

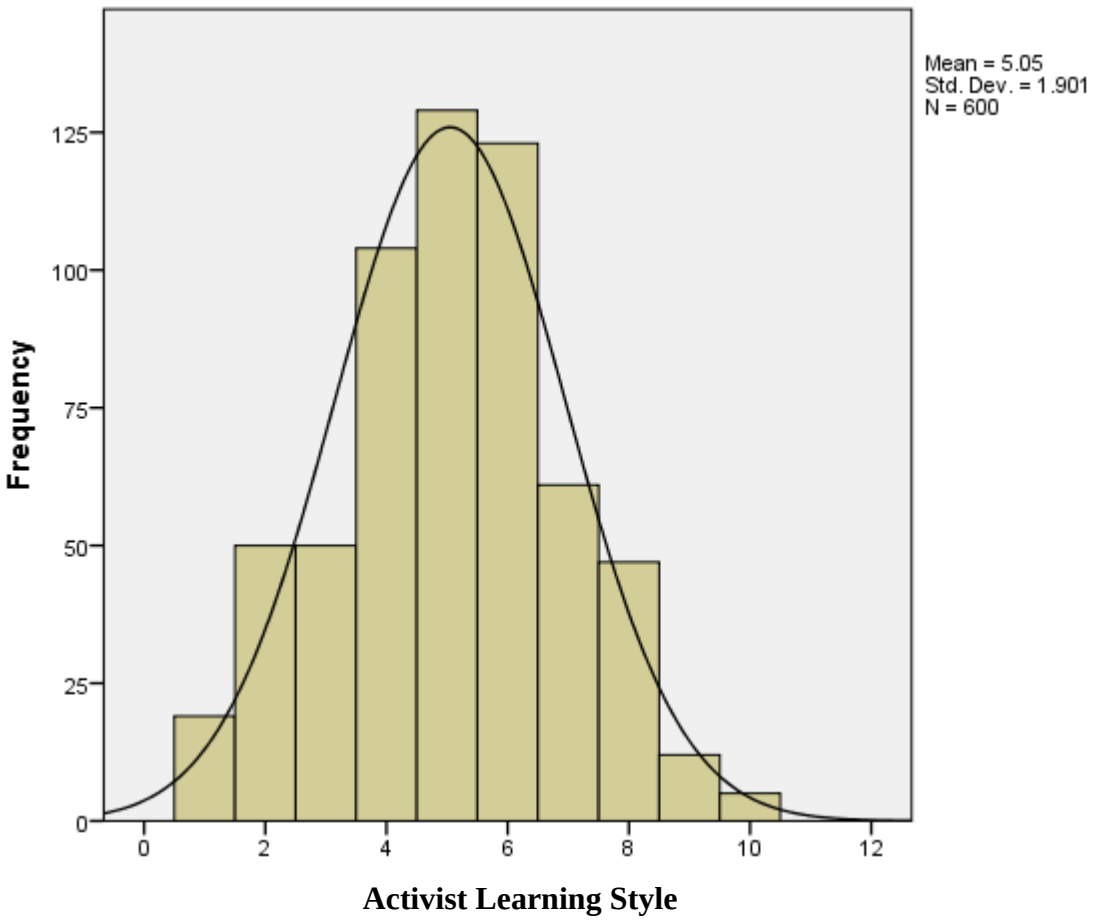

*Figure 7.*The graphical representation of the distribution of scores of Activist Learning style

Table 3 shows that the Mean (6.53), Median (7.00), and Mode (6.00) of Theorist Learning Style of Secondary School Students are almost equal. The Standard Deviation (1.726) indicates that the scores of Theorist Learning Style do not deviate much from the mean. The indices of Skewness (-0.214) and Kurtosis (-.643) indicate that the distribution is slightly negatively skewed, and slightly leptokurtic in nature for the scores of Theorist Learning Style of Secondary School Students. Thus, the distribution of the scores of Theorist Learning style of secondary school students shows that the distribution is approximately normal.

The graphical representation of the distribution of scores of Theorist Learning style is given in Figure 8.

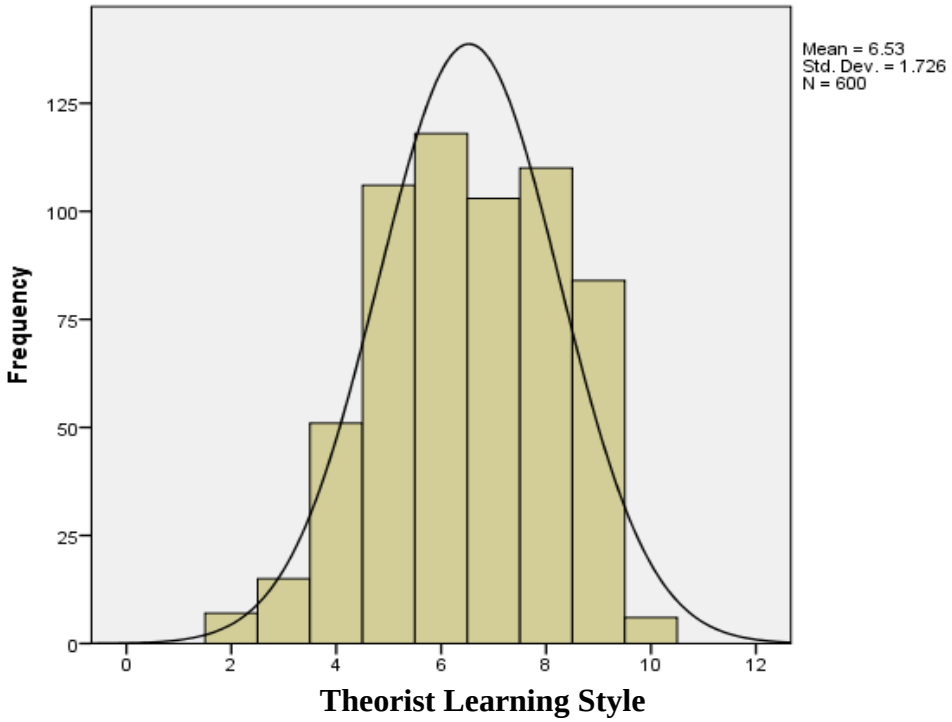

Figure 8.:The graphical representation of the distribution of scores of Theorist Learning style

As per Table 3, Mean (5.66), Median (6.00), and Mode (7.00) of Pragmatist Learning Style of Secondary School Students are nearly equal. The Standard Deviation (1.807) indicates that the scores of Pragmatist Learning Style do not deviate much from the mean. The indices of Skewness (-0.461) and Kurtosis (0.029) indicate that the distribution is slightly negatively skewed, and slightly leptokurtic in nature for Pragmatist Learning Style of Secondary School Students. Thus, the distribution of the scores of Pragmatist Learning style of secondary school students shows that the distribution is almost normal.

The graphical representation of the distribution of scores of Pragmatist Learning style is given in Figure 9.

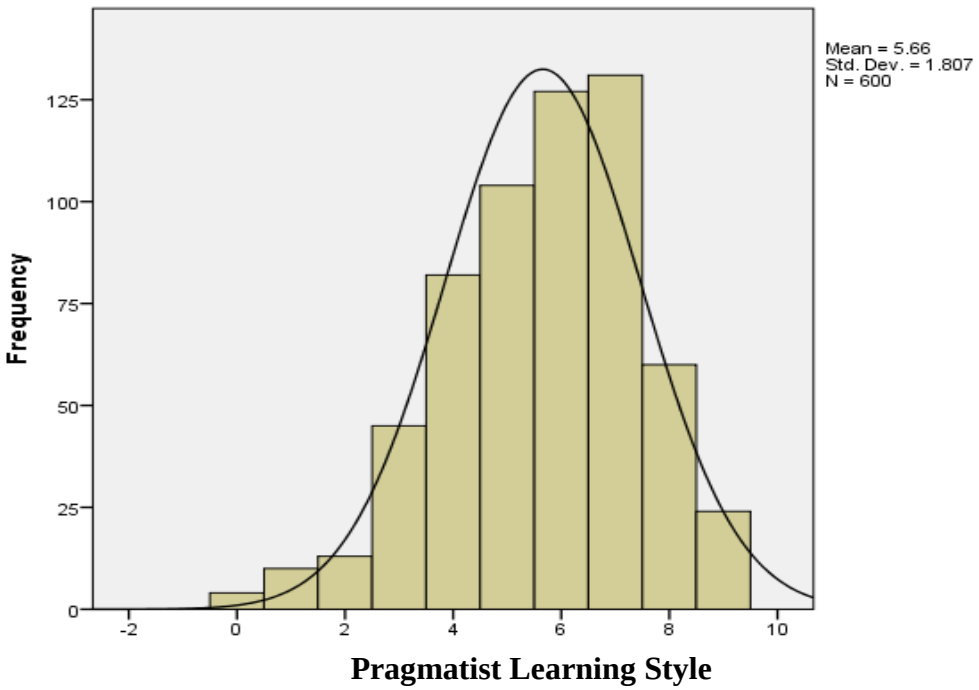

*Figure 9.*The graphical representation of the distribution of scores of Pragmatist Learning style

Table 3 points that the Mean (6.70), Median (7.00), and Mode (8.00) of Reflector Learning Style of Secondary School Students coincide approximately. The Standard Deviation (1.704) score indicates that the scores of Reflector Learning Style do not deviate much from the mean. The indices of Skewness (-.379) and Kurtosis (-.440) indicate that the distribution is slightly negatively skewed and slightly leptokurtic in nature for Reflector Learning Style of Secondary School Students. Thus, the distribution of the scores of Reflector Learning style of secondary school students shows that the distribution follows approximate normality.

The graphical representation of the distribution of scores of Reflector Learning style is given in Figure 10

Figure 10. The graphical representation of the distribution of scores of Reflector Learning style

The important statistical constants for the distribution of scores for Mathematics Self-Efficacy of secondary school students for total sample are calculated and presented in Table 4.

Table 4

Descriptive Statistics of the Variable Mathematics Self-Efficacy of Secondary School Students for the Total Sample.

Variables	Category	Number	Mean	Median	Mode	SD	Skewness	Kurtosis
Mathematics Self-Efficacy	Total	600	127.65	126	131	16.368	.567	.067

Table 4 shows that the obtained value of mean, median and mode for the dependent variable, Mathematics Self-Efficacy of secondary school students are 127.65, 126.00 and 131.00 respectively for the total sample. It indicates that the value of mean, median and mode coincide approximately for the total sample. The indices of skewness (sk=0.567) show that the distribution of the scores of Mathematics Self-Efficacy of the secondary school students is positively skewed for the total sample. The indices of kurtosis for Mathematics Self-Efficacy reveals that the distribution of scores of Mathematics Self-Efficacy (K=0.67) is slightly leptokurtic in nature for the total sample of the secondary students. Thus, the distribution of the scores of Mathematics Self-Efficacy of secondary school students shows that the distribution is approximately normal.

The graphical representation of the distribution of scores of Mathematics Self-Efficacy for the total sample is given in Figure 11.

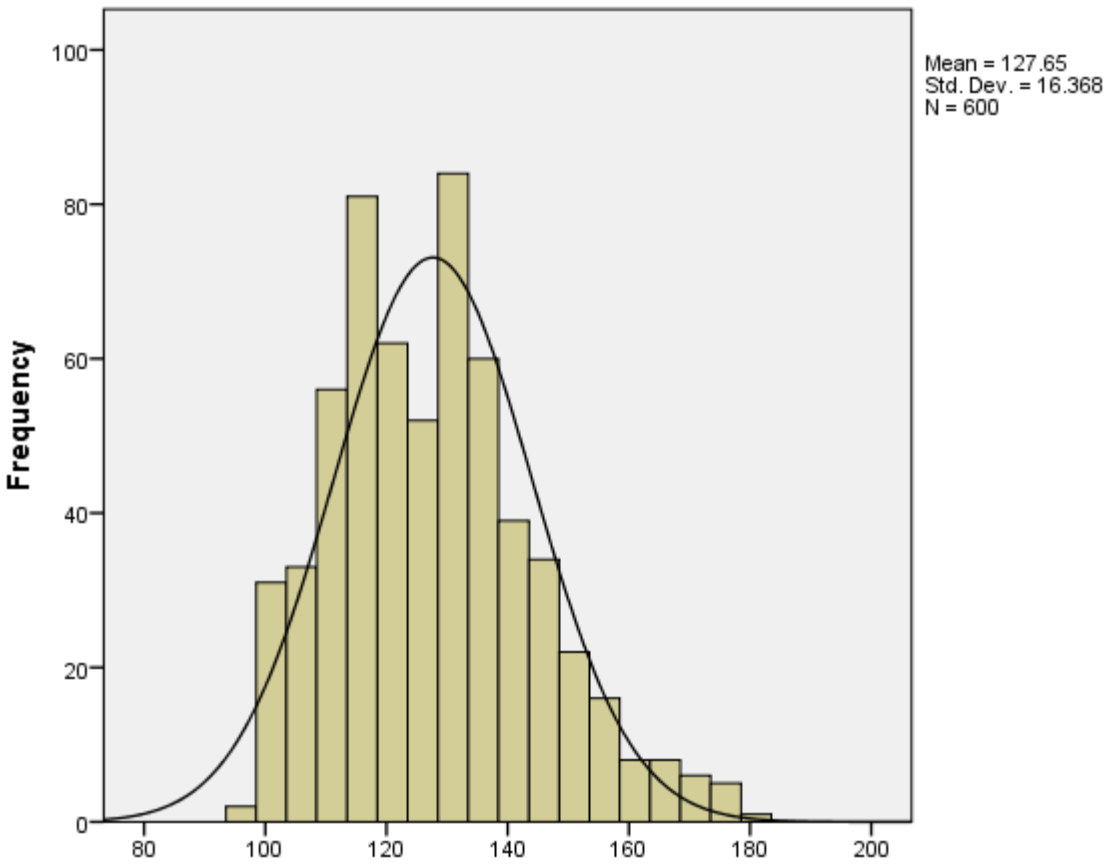

*Figure 11.*Graphical representation of the distribution of scores of Mathematics Self-Efficacy for the total sample

From Figure 11 it is evident that the distribution of scores of Mathematics Self-Efficacy of secondary school students is approximately normal.

Major Analysis

This section deals with the results of major statistical techniques such as percentage analysis, mean difference analysis, correlation and analysis of variance. The results obtained in this analysis are described in detail under the following subsections.

Percentage Analysis

Percentage Analysis was used to find out the extent of Mathematics Self-Efficacy of secondary school students and to identify the Learning Style preferred by secondary school students for the total sample and subgroups based on gender, type of management and locale of schools.

Learning Style Preference of Secondary School Students for the Total Sample and the subgroups Based on Gender, Local and Type of Management of the Schools

The first objective of the study is to identify the type of Learning Style preferred by the secondary school students for the total sample and subgroups based on gender, type of management of schools and locale of schools. The Learning Styles of secondary school students is mainly represented by Activist, Theorist, Pragmatist and Reflector. Percentage Analysis was used to identify the type of Learning Styles adopted by secondary school students for the total sample and the subgroups based on gender, locale and type of management of the schools. The results of the percentage analysis are presented in Table 5

Table 5

Learning style Preference of Secondary School Students for the Total Sample and the subgroups based on Gender, Local and Type of Management of the Schools.

Learning styles		Total	Gender		Locale		Type of management		
			Male	Female	Rural	Urban	Govt	Aided	Unaided
Activist	N	69	36	33	38	31	15	21	33
	%	11.5	52.17	47.83	55.07	44.93	21.74	30.43	47.83
Theorist	N	227	105	122	110	117	70	117	40
	%	37.83	46.25	53.74	48.46	51.54	30.84	51.54	17.62
Pragmatist	N	70	38	32	36	34	13	35	22
	%	11.66	54.28	45.71	51.43	48.57	18.57	50	31.43
Reflector	N	234	121	113	115	119	43	106	85
	%	39	51.71	48.29	49.14	50.85	18.38	45.3	36.32

Table 5 shows that, out of 600 Secondary School Students, only 69 students (11.5%) prefer Activist Learning Style, 227 students (37.83%) prefer Theorist Learning Style,70 Secondary School Students (11.66%) prefer Pragmatist Learning Style and 234(39%) prefer Reflector Learning Style. Thus, it is evident that among the total sample of secondary school students, the most preferred Learning Style is Reflector Learning Style, followed by Theorist Learning Style. It is also evident that the least preferred Learning Styles are Activist and Pragmatist among the secondary school students for total sample.

Table 5 also shows that, out of 300 male secondary school students, 36 male students (52.17%) prefer Activist Learning Style, 105 male students (46.25%) prefer

Theorist Learning Style, 38 male students (54.28%) prefer Pragmatist Learning Style and 121 male students (51.71%) prefer Reflector Learning Style. Thus, it can be inferred that the majority of the male secondary school students prefer the Reflector Learning Style followed by the Theorist Learning Style. The least preferred learning style of male secondary school students is pragmatist and activist. Among the 300 female secondary school students, 33 students (47.83%) prefer Activist Learning Style, 122 students (53.74%) prefer Theorist Learning style, 32 students (45.71%) prefer Pragmatist Learning Style and 113 students (48.29%) are prefer Reflector Learning Style. Thus, it is evident that the most preferred learning style of female secondary school students is Theorist Learning Style, followed by Reflector Learning Style. The least preferred Learning Styles of female secondary school students are pragmatist and activist.

Table 5 points out that for the sub group based on Locale of the Institution, out of 300 Secondary School Students from Urban area 31 students (44.93%) prefer Activist Learning Style, 117 students (51.54%) prefer Theorist Learning Style, 34 Students (48.57%) prefer Pragmatist Learning Style and 119 students (50.85%) prefer Reflector Learning Style. This indicates that the majority of secondary school students in Urban schools prefer Reflector Learning Style followed by Theorist Learning Style. The least preferred Learning Styles of secondary students in Urban schools are Activist and Pragmatist.

Table 5 indicates that, in the case of students from Rural area, out of 300 students, 38 students (55.07%) prefer the Activist learning style, 110 students (48.46%) prefer Theorist Learning Style, 36 students (51.43%) prefer Pragmatist

Learning Style and 115 students (49.14%) prefer Reflector Learning Style . This indicates that the majority of secondary school students in Rural schools prefer Reflector Learning Style, followed by Theorist Learning Style. The least preferred Learning Styles of secondary students in Rural schools are Pragmatist and Activist. Hence, the result of percentage analysis shows that the majority of the Secondary School Students from Urban and Rural area prefer Reflector learning style. Less number of Urban and Rural students belongs to Activist and Pragmatist learning styles respectively.

The result of percentage analysis of the subsample based on Type of Management of the schools, Table 5 shows that out of 140 secondary school students from Government sector; only 15 students (21.74%) prefer Activist Learning Style, 70 students (30.84%) prefer Theorist Learning Style, 13 students (18.57%) prefer Pragmatist Learning Style and 43 students (18.38%) prefer Reflector Learning Style. For the 280 Secondary School Students from Aided sector, 21 students (30.43%) prefer Activist Learning Style, 117 students (51.54%) prefer Theorist Learning Style, 35 students (50%) prefer Pragmatist Learning Style and 106 students (45.3%) prefer Reflector Learning Style. And finally, out of 180 secondary school students from Unaided sector; 33 students (47.83%) prefer Activist Learning Style, 40 students (17.62%) prefer Theorist Learning Style, 22 Students (31.43%) prefer Pragmatist Learning Style and 85 students (36.32%) prefer Reflector Learning Style. So the majority of the Government and Aided secondary school students prefer Theorist Learning Style and in case of Unaided sector majority of secondary school students prefer Reflector Learning Style. Less number

of the Government and Unaided Secondary School Students prefer Pragmatist Learning Style, and in case of Aided sector less number of Secondary School Students prefer Activist Learning Style.

Extent of Mathematics Self-Efficacy of Secondary School Students

The second objective of the study is to find out the extent of Mathematics Self-Efficacy of secondary school students. The classification of the sample in to High Mathematics Self-Efficacy group, Average Mathematics Self-Efficacy group and Low Mathematics Self-Efficacy group were done on the basis of sigma (σ) distance from the Mean. Students having a score with M + σ and above (144 and above) in Mathematics Self-Efficacy were treated as High Mathematics Self-Efficacy group, those with score M- σ and below (111 and below) were included in Low Mathematics Self-Efficacy group and those having score in between M +σ and M- σ (between 144 & 111) were treated as Average Mathematics Self-Efficacy group. Percentage analysis was used to determine the percentage of students in each group. Percentage of students in High Mathematics Self-Efficacy group, Average Mathematics Self-Efficacy group and Low Mathematics Self-Efficacy group are presented in Table 6.

Table 6

Percentage of students in High-Average-Low Mathematics Self-Efficacy groups.

Mathematics Self-efficacy					
High Mathematics Self-efficacy		Average Mathematics self-efficacy		Low Mathematics Self-efficacy	
N	%	N	%	N	%
100	16.67	402	67	98	16.33

Table 6 shows that, out of 600 secondary school students, 100 students (16.67%) are having High Mathematics Self-Efficacy, 402 students (67%) i.e. majority of secondary school students are having average Mathematics Self-Efficacy and 98 students (16.33%) are having low Mathematics Self-Efficacy. Thus, it can be concluded that the majority of the secondary school students are having average level of Mathematics Self-Efficacy

The extent of Mathematics Self-Efficacy of secondary school students was also calculated by comparing the neutral value obtainable for the Scale on Mathematics Self-Efficacy and the mean value obtained. The mean value obtained for Mathematics Self-Efficacy of secondary school students is 127.65.The maximum obtainable score in Scale on Mathematics Self-Efficacy is 195. The neutral value of the scale is 117. As the obtained mean score of Mathematics Self-Efficacy of secondary school students is greater than the neutral value obtainable for Scale on Mathematics Self-Efficacy, it can be inferred that the secondary school students are having an average level of Mathematics Self-Efficacy.

Mean Difference Analysis

Mean difference analysis was carried out to test whether there exists any group differences in the mean scores of Mathematics Self-Efficacy with respect to gender, locale of schools and type of management of schools. The intention is to analyze whether there exist any difference in the mean scores of Mathematics Self-Efficacy of secondary school students for the subgroups based on gender, type of management of schools and locale of schools. For this, mean and standard deviation of the distributions of scores of independent and dependent variables were calculated for the total sample and the sub groups based on gender (Male and Female), locality of the schools (Rural and Urban) and type of Management of the schools (Government, Aided and Unaided) of secondary school students. As all the subgroups are of large size, t-test formula for large independent sample was used totest the significance difference between the mean scores of Mathematics Self-Efficacy for male and female secondary school students and for urban and rural secondary school students. One way ANOVA was used to test the significance difference between the mean scores of Mathematics Self-Efficacy for secondary schools students based on type of management of schools.

- ***Comparison of the mean scores of Mathematics Self-Efficacy of male and female students of secondary schools.***

The data and results of the test of significance difference between the mean scores of Mathematics Self-Efficacy for male and female students of secondary schools are presented in Table 7.

Table 7

Data and results of the test of significance difference between mean scores of Mathematics Self-Efficacy of male and female secondary school students.

Gender	N	Mean	SD	t-value	Level of significance
Male	300	127.63	16.141	.040	NS
Female	300	127.68	16.619		

Table 7 indicates that the t-value obtained is 0.040, which is less than the tabled value at 0.05 level of significance (1.96). The mean score of Mathematics Self-Efficacy of male students is 127.63 and a female student is 127.68. The standard deviation obtained for male students is 16.141 and a female student is 16.619. Since the t-value obtained is less than the tabled value, it can be concluded that there exists no significant difference in the mean scores of Mathematics Self-Efficacy of male and female students of secondary schools. Thus, the male and female secondary students are having same level of Mathematics Self-Efficacy.

- ***Comparison of the mean scores of Mathematics Self-Efficacy of urban and rural secondary school students.***

The data and results of the test of significance difference between the mean scores of Mathematics Self-Efficacy for urban and rural secondary school students are presented in Table 8

Table 8

Data and Results of the Test of Significance difference between the Mean Scores of Mathematics Self-Efficacy for Urban and Rural Secondary School Students

Locality of the Institution	N	Mean	SD	t-value	Level of significance
Urban	301	128.45	17.531	1.194	NS
Rural	299	126.85	15.095		

Table 8 indicates that the t-value obtained is 1.194, which is less than the tabled value at 0.05 level (1.96). The mean score of Mathematics Self-Efficacy of urban school students is 128.45 and rural school students is 126.85. The standard deviation obtained for urban school students is 17.531 and rural school students is 15.095. Since the t-value obtained is less than the tabled value, it can be concluded that there exists no significant difference in the mean scores of Mathematics Self-Efficacy of urban and rural secondary school students. Thus, the secondary school students do not differ in the level of Mathematics Self-Efficacy on the basis of locale of schools.

- ***Comparison of the mean scores of Mathematics Self-Efficacy of government, aided and unaided secondary school students.***

The data and results of the test of significance difference between the mean scores of Mathematics Self-Efficacy for secondary schools students based on type of management of schools are presented in Table 9.

Table 9

Data and Results of the Test of Significance difference between the Mean Scores of Mathematics Self-Efficacy for Secondary Schools Students based on Type of Management of Schools

	Sum of squares	Df	Mean square	F	Sig
Between groups	2035.403	2	1017.701	3.835	.05
Within groups	158446.490	597	265.405		
Total	160481.893	599			

From Table 9, it is evident that the F value obtained for Mathematics Self-Efficacy of secondary school students for the subgroups based on Type of Management of the schools is 3.835 for (2,599) df is greater than the tabled value of F (3.01) required at .05 level of significance. Thus, there exists significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students belongs to Government, Aided and Unaided secondary schools.

In order to know which groups differ in their scores on Mathematics Self-Efficacy, Scheffe test of Post Hoc comparison of mean scores of Mathematics Self-Efficacy of secondary school students for subgroups based on type of management of schools are calculated and presented in Table 10

Table 10

Scheffe Test of Post Hoc comparison for Government, Aided and Unaided groups of Secondary School Students on Mathematics self-efficacy

Group	N	Subset for alpha = 0.05	
		1	2
Unaided	180	125.05	
Aided	279	128.18	128.18
Government	141		129.94

Table 10 shows that the difference in the mean scores of Mathematics Self-Efficacy of Unaided secondary school students (M = 125.05) and Government secondary school students (M = 129.94) is significant. It also shows that the difference in the mean scores of Mathematics Self-Efficacy of Unaided secondary school students (M = 125.05) and Aided secondary school students (M = 128.18) is not significant. Similarly, the difference in the mean scores of Mathematics Self-Efficacy of Aided secondary school students (M = 128.18) and Government secondary school students (M = 129.94) are not significant. The comparison of mean scores revealed that government secondary school students are having high Mathematics Self-Efficacy than aided and unaided secondary school students.

Correlation Analysis

The fourth objective is to analyze whether there exist any relationship between various Learning Styles and Mathematics Self-Efficacy of secondary school students for the total sample The Pearson's product moment correlation was used to find relationship between various Learning Styles and Mathematics Self-Efficacy of

secondary school students. The details regarding coefficient of correlation between various Learning Styles and Mathematics Self-Efficacy of secondary school students for the total sample is given in Table 11

Table 11

Relationship between various Learning Styles and Mathematics Self-Efficacy of Secondary School Students for the Total Sample

Learning styles	Size of the sample N	r	Level of significance
Activist	600	.053	NS
Theorist	600	.202	0.01
Pragmatist	600	.111	0.01
Reflector	600	.027	NS

Table 11 indicates that the coefficient of correlation between the variable Activist Learning Style and Mathematics Self-Efficacy of secondary school students is .053. The value of correlation is not significant at 0.05level. The magnitude of r indicates that there exist negligible relationship between Activist Learning Style and Mathematics Self-Efficacy of secondary school students. The positive sign of r suggests that the Activist Learning Style and Mathematics Self-Efficacy of secondary school students is positively related. Thus, it can be concluded that there is no significant relationship between the Activist Learning Style and Mathematics Self-Efficacy of secondary school students.

Table 11 indicates that the coefficient of correlation between the Theorist Learning Style and Mathematics Self-Efficacy of secondary school students is .202.

The value of correlation is significant at 0.01 level. The magnitude of r indicates that negligible relationship exists between Theorist Learning Style and Mathematics Self-Efficacy of secondary school students. The positive sign of r suggests that the Theorist Learning Style and Mathematics Self-Efficacy of secondary school students is positively related. Thus, there exist a significant positive but negligible relationship between the Theorist Learning Style and Mathematics Self-Efficacy of secondary school students.

Table 11 indicates that the coefficient of correlation between the Pragmatist Learning Style and Mathematics Self-Efficacy of secondary school students is .111. The value of correlation is significant at 0.01 level. The magnitude of r indicates that negligible relationship exists between Pragmatist Learning Style and Mathematics Self-Efficacy of secondary school students. The positive sign of r suggests that the Pragmatist Learning Style and Mathematics Self-Efficacy of secondary school students is positively related. Thus, there exist a significant positive but negligible relationship between the Pragmatist Learning Style and Mathematics Self-Efficacy of secondary school students.

Table 11 indicates that the coefficient of correlation between the Reflector Learning Style and Mathematics Self-Efficacy of secondary school students is .027.The value of correlation is not significant at 0.05level. The magnitude of r indicates that negligible relationship exists between Reflector Learning Style and Mathematics Self-Efficacy of secondary school students. The positive sign of r suggests that the Reflector Learning Style and Mathematics Self-Efficacy of secondary school students is positively related. Thus, it can be inferred that ther eis

no significant relationship between the Reflector Learning Style and Mathematics Self-Efficacy of secondary school students.

One-way Analysis of Variance

One-way analysis of variance was carried out to know the influence of independent variable, Learning Styles i.e. Activist, Theorist, Pragmatist and Reflector, on the dependent variable, Mathematics Self-Efficacy of secondary school students.

Influence of Learning Styles on Mathematics Self-Efficacy of secondary school students

The data were analyzed by using ANOVA to understand the influence of Learning Styles on Mathematics Self-Efficacy of secondary school students. The results of ANOVA are presented in Table 12

Table 12

Influence of Learning Styles on Mathematics Self-Efficacy of Secondary School Students

	Sum of squares	df	Mean square	F	Sig
Between groups	3342.910	3	1114.303	4.226	.006
Within groups	157138.983	596	263.656		
Total	160481.893	599			

Table 12 shows that the F value for Learning Styles on Mathematics Self-Efficacy for the total sample of secondary school students is 4.226 which is greater

than the tabled value 3.814 for degrees of freedom (3,599) required for significance at .01 level. It indicates that there exists significant influence of Learning Styles on Mathematics Self-Efficacy of secondary school students for total sample.

The data were further analyzed with the help of Scheffe's Test of Post Hoc Comparison to know which Learning Style influence more on Mathematic Self-Efficacy of secondary school students. The result of Scheffe's Test of Post Hoc Comparison on various Learning Styles on Mathematics Self-Efficacy of secondary school students is presented in Table 13.

Table 13

Scheffe Test of Post Hoc comparison on various Learning Style influence more on Mathematic Self-Efficacy of secondary school students

Group	N	Subset for alpha = 0.05	
		1	2
Pragmatist	70	122.93	
Reflector	234	126.50	126.50
Activist	69	128.01	128.01
Theorist	227		130.19

From Table 13 it is evident that there exist no significant difference in the mean scores of Mathematics Self-Efficacy for those students who prefer Pragmatist (M=122.93) and Reflector (M=126.50) Learning Styles, Reflector (M=126.50) and Activist (M=128.01) Learning Styles and Activist (M=128.01) and Theorist (M=130.19) Learning Styles. But there exists significant difference in the mean

scores of Mathematics Self-Efficacy for those students who prefer Pragmatist (M=122.93) and Theorist (M=130.19) Learning Styles.

The comparison of the mean scores of Mathematics Self-Efficacy revealed that the students who prefer Theorist Learning Style (M=130.19) are having high mathematics self-efficacy than those students who prefer Pragmatist Learning Styles (M=122.93). Hence, those students who prefer Theorist Learning Style posses high Mathematics Self-Efficacy followed by Activist Learning Style than those who prefer Reflector and Pragmatist Learning Styles among secondary school students. Thus it can be inferred that among the various Learning Styles, the Theorist Learning Style is having greater influence on Mathematics Self-Efficacy of secondary school students.

CHAPTER V

MAJOR FINDINGS, CONCLUSIONS AND SUGGESTIONS

- Study in Retrospect
- Major Findings of the Study
- Tenability of Hypotheses
- Educational Implications
- Suggestions for Further Research

SUMMARY, FINDINGS AND SUGGESTIONS

This chapter provides an overview of the significant aspects of the various stages of the study. The chapter is organized under the following headings:

- Study in Retrospect
- Major Findings of the Study
- Tenability of Hypotheses
- Educational Implications
- Suggestions for Further Research

Study in Retrospect

This section tries to make a retrospective study of different stages of the present study such as statement of the problem, variables of the study, objectives of the study, hypotheses and methodology used for the study.

Restatement of the Problem

The study is entitled as;

INFLUENCE OF LEARNING STYLES ON MATHEMATICS SELF-EFFICACY OF SECONDARY SCHOOL STUDENTS

Variables of the Study

The variables used for the study are:

- *Independent Variable:* Learning Styles
- *Dependent Variable:* Mathematics Self-Efficacy

Objectives of the Study

The objectives of the study are:

1. To identify the type of Learning Style preferred by the secondary school students for total sample and subgroups based on gender, type of management of schools and locale of schools.
2. To find out the extent of Mathematics Self-Efficacy of secondary school students.
3. To analyze whether there exist any significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students for the subgroups based on gender, type of management of schools and locale of schools.
4. To analyze whether there exist any significant relationship between various Learning Styles and Mathematics Self-Efficacy of secondary school students for the total sample.
5. To find out the influence of various Learning Styles on Mathematics Self-Efficacy of secondary school students for the total sample.

Hypotheses of the Study

The hypotheses formulated for the study are:

1. There is no significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students for the subgroup based on gender.
2. There is no significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students for the subgroup based on type of management of schools.

3. There is no significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students for the subgroup based on locale of schools.
4. There is no significant relationship between various Learning Styles and Mathematics Self-Efficacy of secondary school students.
5. There is no significant influence of various Learning Styles on Mathematics Self-Efficacy of secondary school students for the total sample.

Methodology

Method Used

Survey method was used for the present study.

Sample

The population considered for the present study is secondary school students in Kerala. The study was carried out on a sample of 600 secondary school students of standard VIII selected from various secondary schools of Kozhikode and Malappuram districts of Kerala state. Stratified sampling technique was used by giving due representation to strata such as gender, type of management of schools and locale of schools.

Tools Used For Data Collection

The tools used for the present study are:

- Scale on Mathematics Self-Efficacy (Niranjana& Nimisha,2019)
- Learning Style Inventory (Mumthas & Fasi, 2014)

Statistical technique to be used

For the purpose of analyzing the collected data following statistical techniques were used:

- Descriptive statistics
- Percentage analysis
- t-Test (Test the significant difference between the means of two groups)
- Pearson Product-Moment Correlation
- Analysis of Variance (ANOVA)

Major Findings of the Study

Important findings of the study are presented below:

1. Percentage analysis shows out of total sample of secondary school students, the most preferred Learning Style is Reflector Learning Style, followed by Theorist Learning Style. It is also evident that the least preferred Learning Styles are Activist and Pragmatist among the secondary school students.
2. The majority of the male secondary school students prefer the Reflector Learning Style followed by the Theorist Learning Style. The least preferred Learning Styles of male secondary school students are Pragmatist and Activist.
3. The most preferred Learning Style of female secondary school students is Theorist Learning Style, followed by Reflector Learning Style. The least preferred Learning Styles of female secondary school students are Pragmatist and Activist.

4. The majority of secondary school students in rural schools prefer Reflector Learning Style, followed by Theorist Learning Style. The least preferred Learning Styles of secondary students in rural schools is Pragmatist followed by Activist.
5. The majority of secondary school students in urban schools prefer Reflector Learning Style, followed by Theorist Learning Style. The least preferred Learning Styles of secondary students in urban schools are Activist and Pragmatist.
6. The majority of the government and aided Secondary school students prefer Theorist Learning Style and in case of unaided schools majority of secondary school students prefer Reflector Learning Style. Less number of the Government and Unaided Secondary School Students prefer Pragmatist Learning Style, and in case of Aided sector less number of Secondary School Students prefer Activist Learning Style.
7. The t-value obtained for Mathematics Self-Efficacy is .040, which is less than the tabled value at 0.05 level (1.96). Since the t-value obtained is less than the tabled value, it can be concluded there exists no significant difference in the mean scores of Mathematics Self-Efficacy of male and female students of secondary schools.
8. The t-value obtained for Mathematics Self-Efficacy is 1.194, which is less than the tabled value at 0.05 level (1.96). Since the t-value obtained is less than the tabled value, it can be concluded that there exists no significant difference in the mean scores of Mathematics Self-Efficacy of urban and rural secondary school students.

9. The F value obtained for Mathematics Self-Efficacy of secondary school students for the subgroups based on type of management of the schools is 3.835 for (2,599) df is greater than the tabled value of F (3.01). Thus, there exists significant difference in the mean scores of Mathematics Self-Efficacy among various government, aided and unaided secondary school students. Scheffe test of Post Hoc comparison revealed that government secondary school students are having high Mathematics Self-Efficacy than aided and unaided secondary school students.

10. Coefficient of correlation between the variable Activist Learning Style and Mathematics Self-Efficacy of secondary school students is .053. The value is not significant at 0.05 level. Thus, the relationship between Activist Learning Style and Mathematics Self-Efficacy of secondary school students is not significant.

11. Coefficient of correlation between the Theorist Learning Style and Mathematics Self-Efficacy of secondary school students is .202 and the value obtained is significant at 0.01 level. Thus, there exist a significant positive but negligible relationship between the Theorist Learning Style and Mathematics Self-Efficacy of secondary school students.

12. Coefficient of correlation between the Pragmatist Learning Style and Mathematics Self-Efficacy of secondary school students is .111.The value of correlation is significant at 0.01 level. Thus, there exist a positive significant but negligible relationship between the Pragmatist Learning Style and Mathematics Self-Efficacy of secondary school students.

13. Coefficient of correlation between the Reflector Learning Style and Mathematics Self-Efficacy of secondary school students is .027.The value of correlation is not significant at 0.05 level. Thus, the relationship between Reflector Learning Style and Mathematics Self-Efficacy of secondary school students is not significant.

14. The F value for Learning Styles on Mathematics Self-Efficacy for the total sample of secondary school students is 4.226 which is greater than the tabled value 3.814 for degrees of freedom (3,599) required for significance at .01 level. It indicates that there exists significant influence of Learning Styles on Mathematics Self-Efficacy of secondary school students for total sample.

15. The result of Scheffe's Test of Post Hoc Comparison on various Learning Styles on Mathematics Self-Efficacy of secondary school students revealed that among the various learning styles those students who prefer the Theorist Learning Style are having high Mathematics Self-Efficacy among secondary school students than those students who prefer Reflector, Activist and Pragmatist Learning Styles

Conclusion

The results revealed that majority of the secondary school students prefer Reflector Learning Style. Majority of the male secondary school students prefer the Reflector Learning Style and female secondary school students prefer Theorist Learning Style. Majority of the Secondary School Students from Urban and Rural area prefer Reflector learning style. Majority of the Government and Aided

Secondary School Students prefer Theorist learning style and Unaided Secondary School Students prefer Reflector Learning Style.

The results also indicated that Mathematics Self-Efficacy of secondary school students do not differ significantly with respect to gender and locale of schools. But Mathematics Self-Efficacy of secondary school students differs significantly on the basis of type of management of schools. Government secondary school students are having high Mathematics Self-Efficacy than Aided and Unaided secondary school students. The correlation analysis revealed that only Theorist and Pragmatist learning style have significant relation with Mathematics Self-Efficacy of secondary school students. The results of ANOVA revealed that among the various learning styles of secondary school students who prefer Theorist Learning Style are having high Mathematics Self-Efficacy followed by those students who prefer Activist Learning Style than those students who prefer Reflector and Pragmatist Learning Style.

Tenability of Hypotheses

- *The first hypothesis states that there is no significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students for the subgroup based on gender*. The result showed that there is no significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students with respect to gender. *Thus, the first hypothesis is accepted*.
- *The second hypothesis states that there is no significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students for the subgroups based on type of management of schools.* The result showed that there

exists significant difference in the mean scores of Mathematics Self-Efficacy of Government, Aided and Unaided secondary school students. It also revealed that the Government secondary school students are having high Mathematics Self-Efficacy than Aided and Unaided secondary school students. *Thus, the second hypothesis is rejected.*

- *The third hypothesis states that there is no significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students for the subgroups based on locale of schools.* The result showed that there is no significant difference in the mean scores of Mathematics Self-Efficacy of secondary school students with respect to locale of schools. *Thus, the third hypothesis is accepted.*
- *The fourth hypothesis states that there is no significant relationship between various Learning Styles and Mathematics Self-Efficacy of secondary school students.* The result revealed that the relation between Mathematics Self-Efficacy and Theorist as well as Pragmatist Learning Styles are significant for secondary school students, whereas the relationship between Mathematics Self-Efficacy and Reflector as well as Activist Learning Styles are not significant. *Thus, the fourth hypothesis is partially accepted.*
- *The fifth hypothesis states that there is no significant influence of various Learning Styles on Mathematics Self-Efficacy of secondary school students for the total sample.* The result shows that there exists significant influence of Learning Styles on Mathematics Self-Efficacy of secondary school students. Among the four learning styles only the mean scores of Pragmatist and Theorist Learning Styles differ significantly. The students who prefer Theorist Learning

Style are having high Mathematics Self-Efficacy than compared to those students who prefer Activist, Reflector and Pragmatist Learning Style. *Thus, the fifth hypothesis is rejected.*

Educational Implications

The present study is an attempt to find the influence of Learning Styles on Mathematics Self-Efficacy of secondary school students. The results indicated that there exists significant influence of Learning Styles on Mathematics Self-Efficacy of secondary school students. The results of the study is beneficial to policy makers, administrators, teachers and parents to train students for practicing effective learning style in mathematics and to enhance mathematics self-efficacy of secondary school students. In order to learn effectively, it's important to be able to use all four learning styles, but most people have a preference for one or two. The results of the present study revealed that those students who prefer theorist learning style are having high mathematics self-efficacy followed by students who prefer activist learning style than those students who prefer reflector and pragmatist learning styles. Thus, the teachers and parents should provide opportunities to develop theorist learning styles among the secondary school students that helps to enhance the mathematics self-efficacy of the secondary school students which in turn will result in achieving high scores in mathematics.

The research studies revealed that the achievement scores of students for various subjects particularly mathematics is high for those students who are having high mathematics self-efficacy (Kahramanoglu & Deniz, 2017; Perez & Ye, 2013). Research studies also indicated that the overall performance in assessment is

significantly higher for students who follow theorist learning style than pragmatist, reflector and activist learning styles. (Wilkinson. Boohan & Stevenson, 2013).Theorists possess high self-efficacy may be that they tend to think carefully, enjoys the process of analyzing and synthesizing material, draw new information into logical theory and they like to understand the theory behind the actions. Opportunities should be provided by the teachers to develop theorist learning style by engaging the students in learning facts and concepts behind each and every action. The situations which develop theorist learning style such as an activity that is backed up by ideas and concepts that form a model, system or theory with clear structure and purpose can be arranged. Students can be given chance to question and probe to understand a complex situation to develop theorist learning style among secondary school students.

Suggestions for Further Research

The present study was carried out to understand the Influence of Learning Styles on Mathematics Self-Efficacy of secondary school students. By considering the scope and limitations of the study the researcher suggests some areas of research related to this study in which future researchers can concentrate.

1. Secondary school students are the sample of this study. The study can extended to other levels of education.
2. Replication of present study can be carried out with state wide sample.
3. The study was conducted only on four types of learning styles suggested by Honey and Mumford. We can replicate the present study with other learning styles like VAK, Kolb, Dunn and Dunn models etc

4. Interaction effect of learning styles and mathematics self-efficacy on achievement in mathematics can be carried out.
5. Influence of learning styles on other domains can be carried out.
6. In order to study the group differences, the classificatory variables selected for the study were gender, locality and type of management of the schools. The study can be conducted by considering other relevant classificatory variables like level of intelligence, home environment, parental education, socio-economic status etc. of the students.

BIBLIOGRAPHY

BIBLIOGRAPHY

Arbabisarjou, A.,Sotoudeh, M., Zare, S.,Shahrakipour, M.,&Ghoreishinia, G.(2016). Is there any relationship between student's learning styles and self-efficacy?. *International Journal of Humanities and Cultural Studies,3*(1) 1832-1838Retrieved from: http://ijhcs.com/index.php/ijhcs/article/view/1916

Ayotolaa, A., &Adedejib, T. (2009).The relationship between mathematics self-efficacy and achievement in mathematics.*Procedia-Social and Behavioral Sciences, 1*, 953–957. Retrieved from https://doi.org/10.1016/j.sbspro. 2009.01.169.

Bandura, A. (1984). Recycling misconceptions of perceived self-efficacy.*Cognitive Therapy and Research, 8,* 231-255.Retrieved from https://link.springer.com/ article/10.1007/BF01172995.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1994). Self-efficacy.In V. S. Ramachaudran (Ed.), *Encyclopedia of human behavior* (Vol. 4, pp. 71-81). New York: Academic Press. Retrieved from https://www.uky.edu/~eushe2/Bandura/Bandura1994EHB.pdf

Bandura, A. (1997). *Self-efficacy: The exercise of control.* W H Freeman/Times Books/ Henry Holt & Co. Retrieved from.https://psycnet.apa. org/record/ 1997-08589-000

Bandura, A., & Adams, N.E. (1977).Analysis of self-efficacy theory of behavioral change. *Cognitive Therapy and Research,*1, 287–310 . Retrieved from https://doi.org/10.1007/BF01663995

Betz, N. E., & Hackett, G. (1983).The relationship of mathematics self-efficacy expectations to the selection of science-based college majors. *Journal of Vocational Behavior, 23*(3), 329–345. Retrieved from https://doi.org/ 10.1016/0001-8791(83)90046-5

Caliskan, H., & Kilinc, G. (2012). The relationship between the learning styles of students and their attitudes towards social studies course.*Procedia - Social and Behavioral Sciences, 55,* 47 – 56. Retrieved from http;// www. science direct.com

Compact Oxford dictionary. (2004). *Compact Oxford English Dictionary for University and College Students.* Oxford, England: Oxford University Press.

Cooper, H. M. (1989). *Integrating research: A guide for literature reviews* (2nd ed.). Newbury Park, Calif: Sage Publications

Dowling, W. J. (1978). Scale and contour: Two components of a theory of memory for melodies. *Psychological Review, 85*(4), 341–354. Retrieved from https://doi.org/10.1037/0033-295X.85.4.341

Dunn, R. (1984) Learning style: State of the science. *Theory into Practice, 23,* 10-19. doi:10.1080/00405848409543084

Dunn, R. & Dunn, K. (1972).*Practical approaches to individualizing instruction.* West Nyack, New York: Parker Publishing Company Division of Prentice-Hall Publishers, Inc.

Education Commission1966-68.(1966).*Education and national development*. New Delhi: Ministry of Education. Government of India. Retrieved fromhttps://archive.org/stream/ReportOfTheEducationCommission1964-66D.S.KothariReport/48.Jp-ReportOfTheEducationCommission1964-66d.s.kothari_djvu.txt

Edwards, A. L. (1969). *Techniques of attitude scale construction*. New York: Appleton-Century-Crofts, Inc

Ferla, J., Valcke, M,. & Cai, Y, (2015). Academic self-efficacy and academic self-concept: reconsidering structural relationships. *Learning and individual differences,19,* 499-505.Retrieved from http://www.sciepub.com/ reference/ 118132.

Fleming, N.D. (2017). *Teaching and learning styles: VARK Strategies*. Retrieved from https://scholar.google.com/scholar? cites=42434087704 26474769 &as_sdt=2005&sciodt=0,5&hl=en

Fleming, N.D., & Mills, C.M. (1992). Not another inventory, Rather a catalyst for reflection. *A Journal of Educational Development, 11*(1). 137-155.Retrieved from https://doi.org/10.1002/j.2334-4822.1992.tb00213.x

Fasi, Y.(2014).*Comparative study of learning style and academic achievement of boarders and day scholars in social science*. (Unpublished M.Ed Dissertation).Kozhikode Farook Training College

Gafoor, K. A., & Kurukkan, A. (2005).*Why high school students feel mathematics difficult? An exploration of affective beliefs*. Paper presented at the UGC Sponsored National Seminar on Pedagogy of Teacher Education, Trends and Challenges: Kozhikode, Aug 18-19, 2015. Retrieved from https://files.eric.ed.gov/fulltext/ED560266.pdf

Hackett, G., & Betz, N. E. (1989).An exploration of the mathematics self-efficacy/mathematics performance correspondence. *Journal for Research in Mathematics Education,20*(3), 261–273. Retrieved from https://doi.org/10. 2307/749515

Hampton, N. Z., & Mason, E. (2003). Learning disabilities, gender, sources of efficacy, self-efficacy beliefs, and academic achievement in high school students. *Journal of School Psychology*, *41*(2), 101–112. Retrieved from https://doi.org/10.1016/S0022-4405(03)00028-1

Honey, P., & Mumford, A. (1986).*The Manual of Learning Styles*. Retrieved from http://hdl.handle.net/10068/466244

Ishak, N.,& Awang,M.M. (2017). The Relationship of Student Learning Styles and Achievement in History Subject. *The International Journal of Social Sciences and Humanities Invention*, *4*(3), 3372-3377. Retrieved from https://doi.org/10.18535/ijsshi/v4i3.04

Jilardidamavandi, A., Mahyuddin, R., Elias, H., Daud, S. M., &Shabani, J. (2011).Academic Achievement of Students with Different Learning Styles. *International Journal of Psychological Studies,3*(2), 186-193.Retrieved from https://doi.org/10.5539/ijps.v3n2p186

Jinjin, L.(2014).. *An Investigation of University Students' Views about Teaching and Learning English through Their Own Experiences in High Schools and University of Mainland China.* (Doctoraldissertation). Retrieved fromhttps://eprints.utas.edu.au/18699/2/Whole-Lu%2C_Jinjin-thesis.pdf

Kabiri, M. & Kiamanesh, A.R. (2004).*The role of self-efficacy, anxiety, attitudes and previous math achievement in students' math performance*. In Proceedings of the Third International Biennial SELF Research Conference. Retrieved from http://www.self.ox.ac.uk/Conferences /2004_Kabiri_ Kiamenesh

Kahramanoğlu, R., & Deniz, T. (2017).An investigation of the relationship between middle school students' metacognitive skills, mathematics self-efficacy and mathematics achievement. *Inonu University Journal of the Faculty of Education, 18*(3), 189-200.doi: 10.17679/inuefd.334285

Keefe, J.W. (1979).Assessment of Learning Style Variables: The NASSP task force model. *Theory Into Practice,24*(2).138-144. Retrieved from https://www.jstor.org/stable/1476430?seq=1

Kline, M. (1969). *Mathematics and the physical world*. New York, United States: Dover Publications Inc: Retrieved fromhttps://archive. org/ details /op us majusofroger002065mbp/page/n7

Kolb, D. A. (1976).*The learning style inventory: Technical manual*. Retrieved from https://www.researchgate.net/profile/David_Kolb/publication/241157771.

Kolb, D. A. (1981).*Learning styles and disciplinary differences*. Retrieved from https://www.researchgate.net/publication/283922529

Kolb, D. A. (1984).*Experiential learning: Experience as the source of learning and development* (Vol. 1). Englewood Cliffs, NJ: Prentice-Hall.

Kolbe, K. (2009) .*Self-efficacy results from exercising control over personal conative strengths*. Retrieved from https://e.kolbe.com/knol/index.html

Kranzler, J. & Pajares, F., (1997) An Exploratory Factor Analysis of the Mathematics Self-Efficacy Scale—Revised (MSES-R), *Measurement and Evaluation in Counseling and Development*, 29(4), 215-228, doi: 10.1080/07481756.1997.12068906

Lent, R. W., Lopez, F. G., &Bieschke, K. J. (1991). Mathematics self-efficacy: Sources and relation to science-based career choice. *Journal of Counseling Psychology, 38*(4), 424–430. Retrieved from https://doi.org/10.1037/0022-0167.38.4.424

Liu, X., &Koirala, H. (2009).The effect of mathematics self-efficacy on mathematics achievement of high school students.*NERA Conference*

Proceedings 2009. Retrieved from http://digitalcommons.uconn.Edu /nera_2009/30

Lopez, F. G., & Lent, R. W. (1992). Sources of mathematics self-efficacy in high school students. *The Career Development Quarterly, 41*(1), 3–12. Retrieved from https://doi.org/10.1002/j.2161-0045.1992.tb00350.x

Ma, X., & Kishor, N. (1997).Assessing the relationship between attitude towards mathematics and achievement in mathematics: A meta-analysis.*Journal for Research in Mathematics Education,28*(1), 26-47. Retrieved from http:// www .jstor.org/stable/749772.

Ministry of Education (2007). *The New Zealand Curriculum*. Wellington: Learning Media. Retrieved from file:///C:/Users/HP/Downloads/The-New-Zealand-Curriculum.pdf

Moenikiaa, M., & Babelan, A.Z.(2010). The role of learning styles in second language learning among distance education students. *Procedia-Social and Behavioural Sciences, 2* (2) 1169–1173. Retrieved from https://core.ac.uk/ download/pdf/81130437.pdf

Multon, K. D., Brown, S. D., & Lent, R. W. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytic investigation. *Journal of Counseling Psychology,38*(1), 30–38. Retrieved from https://doi.org/10.1037/ 0022-0167.38.1.30

National Policy on Education(1986) *National Education Policy 1986*.New Delhi:MHRD.Government of India. Retrieved from https://mhrd.gov.in/ sites/upload_ files/mhrd/files/upload_document/npe.pdf

Nzesei, M. M. (2015). *A correlation study between learning styles and academic achievement among second school students in Kenya.*(Doctoral dissertation). Retrieved fromhttp://erepository.uonbi.ac.ke/bitstream/handle/11295/93142

Özdemir,M., &Kaptan,F.(2017).Analyzing the Learning Styles of Pre-Service Primary School Teachers. *Journal of Education and Practice,*8(11).137-152 Retrieved from https://files.eric.ed.gov/fulltext/EJ1139677.pdf

Pajares, F. (2002). *Overview of social cognitive theory and self-efficacy*. Retrieved from https://www.uky.edu/~eushe2/Pajares/eff.html

Pajares, F., & Miller, M. D. (1995). Mathematics self-efficacy and mathematics performances: The need for specificity of assessment. *Journal of Counseling Psychology, 42*(2), 190–198. Retrieved from https://doi.org/10.1037/0022-0167.42.2.190

Pajares, F., & Miller, M. D. (1997). Mathematics self-efficacy and mathematical problem solving: Implications of using different forms of assessment. *Journal of Experimental Education,65*(3), 213–228. Retrieved from https://doi.org/10 .1080/00220973.1997.9943455

Perez,E. D.,& Ye, Y.(2013) .The relationship between mathematics self-efficacy and mathematics achievement of mathayomsuksa students in the English program of St. iosephbangna school.*Scholar : Human Sciences, 5*(1).82-90.

Retrieved from http://www.assumptionjournal.au.edu/index.php/Scholar/article/view/28

Rahman, A., & Ahmar, A. S.(2017). Relationship between learning styles and learning achievement in mathematics based on genders. *World Transactions on Engineering and Technology Education,*15(1).Retrieved from https://www .researchgate.net/publication/315378811

Rahwanda,D. (2018). An Exploration of Learning Style Preferences Based on Gender of Indonesian Nursing Academy Students, *IOSR Journal of Research & Method in Education,*8(5)40-44.Retrieved fromhttp://iosrjournals.org/iosr-jrme/papers/Vol-8%20Issue-5/Version-1/H0805014044.pdf

Randhawa, B. S., Beamer, J. E., & Lundberg, I. (1993).Role of mathematics self-efficacy in the structural model of mathematics achievement. *Journal of Educational Psychology,*85*(1),*41–48. Retrieved from https://doi.org/10.1037/00 22-0663.85.1.41

Reid, J. M. (1995). Learning styles in the ESL/EFL classroom. Florence, KY: Heinle & Heinle Publishers.

Sabatova, J. (2008). *Learning styles in ELT*. Diploma Unpublished Thesis, Masaryk University Brno. Retrieved from https://is.muni.cz/th/104803

Sahoo, P.K.,& Chandra , S. (2013). A study of learning styles of B.Ed. trainees of IGNOU, *MIER Journal of Educational Studies Trends and Practices, 3*(1), 33-45. Retrieved from http://www.mierjs.in/ojs/index.php/mjestp /article/view/44

Schunk, D. H., & Hanson, A. R. (1985). Peer models: Influence on children's self-efficacy and achievement. *Journal of Educational Psychology,77*.313–322.Retrieved from http://dx.doi. org/10.1037/0022-0663.77.3.313

Schulz, W. (2005). *Mathematics self-efficacy and student expectations: Results from PISA 2003*. Retrieved from https://files.eric.ed.gov/fulltext/ED490044.pdf

Siegle, D., & McCoach, D. B. (2007).Increasing student mathematics self-efficacy through teacher training. Journal of Advanced Academics, 18(2), 278–312. Retrieved from https://www.researchgate.net/publication/241625417

Sims, R.R. (1990). Adapting Training to Trainee Learning Styles. *Journal of European Industrial Training, 14*(2), Retrieved from https:// doi.org/10.1108/03090599010140405

Soanes, C., Spooner, A., &Hawker, S.(2004). *Compact Oxford Dictionary*(9th ed.). New York :University press Inc

Sriphai, S., Damrongpanit, S., &Sakulku, J. (2012). An investigation of learning styles influencing mathematics achievement of seventh-grade students. *Educational Research and Reviews,6*(15),835-842. Retrieved from https://doi.org/10.5897/ERR11.162

Stewart, K. L., & Felicetti, L. A. (1992). Learning styles of marketing majors. *Educational Research Quarterly, 15*(2), 15-23. Retrieved from http://www.nwlink.com/~donclark/hrd/styles.html#sthash.SbepFXmt.dpuf

Thomas, S.(2014). *Effectiveness of cooperative learning on learning styles and academic performance in mathematics learning at the upper primary level.*(Doctoral dissertation). Retrieved from http://hdl.handle.net/10603/22540

Usher, E. L., &Pajares, F. (2009). Sources of self-efficacy in mathematics: A validation study. *Contemporary Educational Psychology, 34*(1), 89–101. Retrieved from https://doi.org/10.1016/j.cedpsych.2008.09.002

Vasanthi, A.(2000).*Education and social change of women in Tamilnadu 1947-2000* (Doctoral dissertation). Retrieved from http://hdl.handle.net/10603/199827

Warwick, J. (2008). Mathematical self-efficacy and student engagement in the mathematics classroom. *MSOR connections, 8*, 31-37. Retrieved from https://www.researchgate.net/publication/228478627

West, C. R., Kahn, J. H., &Nauta, M. M. (2007). Learning styles as predictors of self-efficacy and interest in research: Implications for graduate research training. *Training and Education in Professional Psychology,1*(3), 174–183. Retrieved from https://doi.org/10.1037/1931-3918.1.3.174

Wilinson, T., Boohan , M., & Stevenson, M. (2013). Does learning style influence academic performance in different forms of assessment?.*Journal of Anatomy,6*(4). Retrieved from http://doi:10.1111/joa.12126

Williamson, M. F., & Watson, R. L. (2006). Learning styles research: understanding how teaching should be impacted by the way learners learn part II: understanding how learners prefer to receive information. *Christian*

Education Journal, 3(2), 343.Retrieved from https://www.researchgate.net/ publication /284893261

Zarei, A.A., Esfandiari, R., & Hosseini, G.(2016).*Learning styles and strategies: as predictors of computer use anxiety and computer self-efficacy.* Retrieved from https://www.amazon.com/Learning-Styles-Strategies-Predictors-Self-efficacy/dp/365984168

APPENDICES

APPENDIX I

FAROOK TRAINING COLLEGE
KOZHIKODE

SCALE ON MATHEMATICS SELF-EFFICACY SCALE
(Malayalam-Draft)

Dr. NIRANJANA. K..P.
Assistant Professor

NIMISHA THILAK. A
M.Ed.Student

നിർദ്ദേശങ്ങൾ

ഗണിതശാസ്ത്രവിഷയവുമായി ബന്ധപ്പെട്ട പ്രസ്താവനകളാണ് താഴെ കൊടുത്തിരിക്കുന്നത്. ഓരോ പ്രസ്താവനയും ശ്രദ്ധാപൂർവ്വം വായിച്ച്, അതിൽ പറയുന്ന കാര്യങ്ങൾ നിങ്ങളെ സംബന്ധിച്ചിടത്തോളം എത്രമാത്രം ശരിയാണെന്ന് തീരുമാനിക്കുക. തന്നിരിക്കുന്ന പ്രതികരണങ്ങളിൽ, പൂർണമായും യോജിക്കുന്നു, യോജിക്കുന്നു, തീരുമാനമില്ല, വിയോജിക്കുന്നു, പൂർണമായും വിയോജിക്കുന്നു എന്നിവയിൽ നിങ്ങൾക്ക് അനുയോജ്യമായതത് തിരഞ്ഞെടുക്കുക. നിങ്ങളുടെ പ്രതികരണങ്ങൾ സ്വകാര്യമായി സൂക്ഷിക്കുകയും, ഗവേഷണാവശ്യങ്ങൾക്കു മാത്രം ഉപയോഗിക്കുന്നും ആണ്.

1. ഗുണനക്രിയകൾ (Multiplication)ചെയ്യാൻ എനിക്ക് ആത്മവിശ്വാസമുണ്ട്
2. പ്രയാസമേറിയ ഗണിത പ്രശ്നങ്ങൾ നിർധാരണം ചെയ്യാൻ ഇഷ്ടപ്പെടുന്നു
3. ഗണിതവുമായി ബന്ധപ്പെട്ട അഭിപ്രായങ്ങൾ തുറന്നു പറയാൻ മടിതോന്നാറുണ്ട്
4. ഗണിതം ഉൾപ്പെടുന്ന കളികളിൽ ജയിക്കാനാകുമെന്ന്എനിക്ക് വിശ്വാസമുണ്ട്
5. ചില ഗണിതപ്രശ്നങ്ങൾ ചെയ്യാൻ ശ്രമിക്കാതെ, എനിക്ക് ഇത് ചെയ്യാനാകില്ല എന്ന് തോന്നാറുണ്ട്
6. വാച്ചിൽ നോക്കി സമയം പറയാൻ എനിക്ക്ആത്മവിശ്വാസക്കുറവുണ്ട്
7. എനിക്ക് ലഭിക്കുന്ന ജോലിയിൽ ഗണിതം ഉപയോഗിക്കാൻ ആത്മവിശ്വസക്കുറവ് ഉണ്ട്
8. എനിക്ക് ഗണിതപ്രശ്നങ്ങൾ നിഷ്പ്രയാസം ചെയ്തു തീർക്കാനാകും
9. സ്കൂളിനു പുറത്ത് ഗണിതം ഉപയോഗിക്കാൻ ആത്മവിശ്വാസമുണ്ട്
10. ഗണിതഅധ്യപകനാകാൻ ഇഷ്ടപ്പെടുന്നു
11. ഹരണക്രിയകൾ (Division) ഞാൻ ചെയ്യാൻ ശ്രമിക്കാറില്ല
12. ഗണിതവുമായി ബന്ധപ്പെട്ട കളികൾ ഫോണിൽ/കമ്പ്യൂട്ടറിൽ കളിക്കാനിഷ്ടമാണ്
13. ഗണിതഹോംവർക്കുകൾ ചെയ്യാൻ താൽപര്യം ഇല്ല
14. പൊതുവായി തെറ്റ് വരുത്തുന്നതിനാൽ ഗണിതക്രിയകൾ ചെയ്യാൻ എനിക്ക് ആത്മവിശ്വാസക്കുറവുണ്ട്

15. കോണുകൾ അളക്കുമ്പോൾ തെറ്റ് വരും എന്നു ഞാൻ വിശ്വസിക്കുന്നു

16. ഗണിതക്ലാസ്സിൽ സംശയങ്ങൾ ചോദിക്കാൻ എനിക്ക് ആത്മവിശ്വാസമുണ്ട്

17. ഗണിതപരീക്ഷയ്ക്ക് തയ്യാറെടുക്കുമ്പോൾ എനിക്ക് പേടി അനുഭവപ്പെടാറുണ്ട്

18. കഠിനപ്രയത്നം കൊണ്ടും ഗണിതത്തിൽ ഉയർച്ച ഇല്ലാത്തത് എന്നിൽ മനോവിഷമം ഉണ്ടാകുന്നു

19. ബീജഗണിതക്രിയകൾ ചെയ്യാനാകും എന്ന വിശ്വാസം എനിക്കുണ്ട്

20. ഗണിത അസൈൻമെൻറ് നല്ല രീതിയിൽ ചെയ്യാനാകുമെന്ന് എനിക്ക് വിശ്വാസമുണ്ട്

21. ഗണിതവിഷയത്തിൽ എനിക്ക് ഉയർന്ന ഗ്രേഡ് ലഭിക്കുകയില്ല

22. ദശാംശസംഖ്യകൾ (Decimal Number) ചോദ്യത്തിൽ കാണുമ്പോൾ തന്നെ ഞാൻ പരിഭ്രമപെടാറുണ്ട്

23. കോമ്പസ് ഉപയോഗിച്ചു കൃത്യതയോടെ ചെയ്യാനാകുമെന്ന് എനിക്ക് വിശ്വാസമുണ്ട്

24. ഗണിതപഠനത്തെ കുറിച്ച് ഓർക്കുമ്പോൾ തന്നെ ഞാൻ സമ്മർദ്ദം അനുഭവിക്കാറുണ്ട്

25. ഗണിത പ്രൊജെക്ടുകൾ ചെയാൻ പ്രത്യേകം താൽപര്യം കാണിക്കാറുണ്ട്

26. ഭിന്നസംഖ്യകളുടെ (Fraction)ക്രിയകൾ എനിക്ക് പ്രയാസമാണ്

27. ഗണിതസമവാക്യങ്ങൾ ഉപയോഗിക്കുമ്പോൾ തെറ്റുവരുമോ എന്ന പേടി ഉണ്ടാകാറുണ്ട്

28. ഗണിതപ്രശ്നങ്ങൾ നിർധാരണം ചെയ്യാൻ എനിക്കാകില്ല

29. ഗണിതം ഉൾപ്പെടുന്ന ഒരു മേഖല തുടർപഠനത്തിനായി ഞാൻ തിരഞ്ഞെടുക്കുകയില്ല

30. ഗണിതക്ലിസ്സിൽ മികച്ച പ്രകടനം കാഴ്ചവെയ്ക്കാനാകുമെന്ന് എനിക്ക് വിശ്വാസമുണ്ട്

31. വ്യവകലനം (Subtraction) മനകണക്കായി ചെയ്യാൻ എനിക്കാകും

32. ഗണിതക്ലാസ്സിൽ മനസിലാകാതെ പോകുന്ന ഭാഗങ്ങൾ മനസിലായില്ലെന്ന് അദ്ധ്യാപകരോട് പറയാറുണ്ട്

33. ഗണിതശാസ്ത്രജ്ഞനാകാൻ ഇഷ്ടപ്പെടുന്നു

34. വിരലുകൾ ഉപയോഗിക്കാതെ വ്യവകലനക്രിയകൾ (Subtraction) ചെയ്യാൻ എനിക്കാകും

35. ഗണിതപരീക്ഷയുടെ ഫലം വരുന്നതിനു മുമ്പ്തന്നെ ഉയർന്ന വിജയം ലഭിക്കുമെന്ന് വിശ്വസിക്കാറുണ്ട്

36. സങ്കലനം (Addition) മനകണക്കായി ചെയ്യാൻ എനിക്കാകും

37. ഗണിത കഴിവുകളെകുറിച്ച് മറ്റുള്ളവർ നല്ലതു പറയുമ്പോൾ അഭിമാനം തോന്നാറുണ്ട്.

38. ഗണിതക്രിയകൾ ബാർഡിൽ ചെയ്യാനുള്ള ആത്മവിശ്വസം എനിക്കുണ്ട്

39. ഗണിതപ്രശ്നങ്ങൾ അഭിമുഖീകരിക്കാൻ എനിക്ക് പ്രയാസമാണ്

40. ഗണിതവിഷയത്തിൽ മികവ് കാണിക്കുന്നില്ലെന്ന് ടീച്ചർ പരാതിപ്പെടാറുണ്ട്

41. ഗണിതക്ലാസ്സിൽ സംശയങ്ങൾ ചോദിക്കാൻ പേടി തോന്നാറുണ്ട്

42. ഗണിതപാഠഭാഗങ്ങളിലെ ചോദ്യങ്ങൾക്ക് ഉത്തരം പറയാൻ കഴിയുമെന്നുറപ്പുണ്ട്

43. പണമിടപാടുകൾ നടത്തുമ്പോൾ എന്റെ ഉള്ളിൽപേടി അനുഭവപ്പെടാറുണ്ട്.

APPENDIX II

FAROOK TRAINING COLLEGE
KOZHIKODE

SCALE ON MATHEMATICS SELF-EFFICACY
(Malayalam-Final)

Dr. NIRANJANA. K.P.NIMISHA THILAK. A
Assistant Professor M.Ed.Student

നിർദ്ദേശങ്ങൾ

ഗണിതശാസ്ത്രവിഷയവുമായി ബന്ധപ്പെട്ട പ്രസ്താവനകളാണ് താഴെ കൊടുത്തിരിക്കുന്നത്. ഓരോ പ്രസ്താവനയും ശ്രദ്ധാപൂർവ്വം വായിച്ച്, അതിൽ പറയുന്ന കാര്യങ്ങൾ നിങ്ങളെ സംബന്ധിച്ചിടത്തോളം എത്രമാത്രം ശരിയാണെന്ന് തീരുമാനിക്കുക. തന്നിരിക്കുന്ന പ്രതികരണങ്ങളിൽ, പൂർണമായും യോജിക്കുന്നു, യോജിക്കുന്നു, തീരുമാനമില്ല, വിയോജിക്കുന്നു, പൂർണമായും വിയോജിക്കുന്നു എന്നിവയിൽ നിങ്ങൾക്ക് അനുയോജ്യമായതത് തിരഞ്ഞെടുക്കുക. നിങ്ങളുടെ പ്രതികരണങ്ങൾ സ്വകാര്യമായി സൂക്ഷിക്കുകയും, ഗവേഷണാവശ്യങ്ങൾക്കു മാത്രം ഉപയോഗിക്കുന്നും ആണ്.

1. ഗുണനക്രിയകൾ (Multiplication)ചെയ്യാൻ എനിക്ക് ആത്മവിശ്വാസമുണ്ട്
2. പ്രയാസമേറിയ ഗണിതപ്രശ്നങ്ങൾ നിർധാരണം ചെയ്യാൻ ഇഷ്ടപ്പെടുന്നു
3. ഗണിതവുമായി ബന്ധപ്പെട്ട അഭിപ്രായങ്ങൾ തുറന്നു പറയാൻ മടി തോന്നാറുണ്ട്
4. ഗണിതം ഉൾപ്പെടുന്ന കളികളിൽ ജയിക്കാനാകുമെന്ന് എനിക്ക് വിശ്വാസമുണ്ട്
5. ചില ഗണിതപ്രശ്നങ്ങൾ ചെയ്യാൻ ശ്രമിക്കാതെ, എനിക്ക് ഇത് ചെയ്യാനാകില്ല എന്ന് തോന്നാറുണ്ട്
6. വാച്ചിൽ നോക്കി സമയം പറയാൻ എനിക്ക് ആത്മവിശ്വാസക്കുറവുണ്ട്
7. എനിക്ക് ലഭിക്കുന്ന ജോലിയിൽ ഗണിതം ഉപയോഗിക്കാൻ ആത്മവിശ്വസക്കുറവ് ഉണ്ട്
8. എനിക്ക് ഗണിതപ്രശ്നങ്ങൾ നിഷ്പ്രയാസം ചെയ്തു തീർക്കാനാകും
9. സ്കൂളിനുപുറത്ത് ഗണിതം ഉപയോഗിക്കാൻ ആത്മവിശ്വാസമുണ്ട്
10. ഹരണക്രിയകൾ (Division) ഞാൻ ചെയ്യാൻ ശ്രമിക്കാറില്ല
11. ഗണിതവുമായി ബന്ധപ്പെട്ട കളികൾ ഫോണിൽ/കമ്പ്യൂട്ടറിൽ കളിക്കാനിഷ്ടമാണ്
12. ഗണിത ഹോംവർക്കുകൾ ചെയ്യാൻ താൽപര്യം ഇല്ല
13. പൊതുവായി തെറ്റ്വരുത്തുന്നതിനാൽ ഗണിതക്രിയകൾ ചെയ്യാൻ എനിക്ക് ആത്മവിശ്വാസക്കുറവുണ്ട്
14. കോണുകൾ അളക്കുമ്പോൾ തെറ്റ്വരും എന്നു ഞാൻ വിശ്വസിക്കുന്നു
15. ഗണിതക്ലാസ്സിൽ സംശയങ്ങൾ ചോദിക്കാൻ എനിക്ക് ആത്മവിശ്വാസമുണ്ട്

16. ഗണിതപരീക്ഷയ്ക്ക് തയ്യാറെടുക്കുമ്പോൾ എനിക്ക് പേടി അനുഭവപ്പെടാറുണ്ട്

17. കഠിനപ്രയത്നം കൊണ്ടും ഗണിതത്തിൽ ഉയർച്ച ഇല്ലാത്തത് എന്നിൽ മനോവിഷമം ഉണ്ടാകുന്നു

18. ബീജഗണിതക്രിയകൾ ചെയ്യാനാകും എന്നവിശ്വാസം എനിക്കുണ്ട്

19. ഗണിത അസൈൻമെൻറ് നല്ലരീതിയിൽ ചെയ്യാനാകുമെന്ന് എനിക്ക് വിശ്വാസമുണ്ട്

20. ഗണിതവിഷയത്തിൽ എനിക്ക് ഉയർന്ന ഗ്രേഡ് ലഭിക്കുകയില്ല

21. ദശാംശസംഖ്യകൾ (Decimal Number) ചോദ്യത്തിൽ കാണുമ്പോൾ തന്നെ ഞാൻ പരിഭ്രമപെടാറുണ്ട്

22. കോമ്പസ് ഉപയോഗിച്ചു കൃത്യതയോടെ ചെയ്യാനാകുമെന്ന് എനിക്ക് വിശ്വാസമുണ്ട്

23. ഗണിതപഠനത്തെകുറിച്ച് ഓർക്കുമ്പോൾ തന്നെ ഞാൻ സമ്മർദ്ദം അനുഭവിക്കാറുണ്ട്

24. ഗണിതപ്രൊജെക്ടുകൾ ചെയാൻ പ്രത്യേകം താൽപര്യം കാണിക്കാറുണ്ട്

25. ഗണിതസമവാക്യങ്ങൾ ഉപയോഗിക്കുമ്പോൾ തെറ്റുവരുമോ എന്ന പേടി ഉണ്ടാകാറുണ്ട്

26. ഗണിതപ്രശ്നങ്ങൾ നിർധാരണം ചെയ്യാൻ എനിക്കാകില്ല

27. ഗണിതം ഉൾപ്പെടുന്ന ഒരു മേഖല തുടർപഠനത്തിനായി ഞാൻ തിരഞ്ഞെടുക്കുകയില്ല

28. ഗണിതക്വിസ്സിൽ മികച്ചപ്രകടനം കാഴ്ചവെയ്ക്കാനാകുമെന്ന് എനിക്ക് വിശ്വാസമുണ്ട്

29. വ്യവകലനം (Subtraction) മനകണക്കായി ചെയ്യാൻ എനിക്കാകും

30. ഗണിതക്ലാസ്സിൽ മനസിലാകാതെ പോകുന്ന ഭാഗങ്ങൾ മനസിലായില്ലെന്ന് അധ്യാപരോട് നിന്ന് പറയാറുണ്ട്

31. വിരലുകൾ ഉപയോഗിക്കാതെ വ്യവകലനക്രിയകൾ (Subtraction) ചെയ്യാൻ എനിക്കാകും

32. സങ്കലനം (Addition) മനകണക്കായി ചെയ്യാൻ എനിക്കാകും

33. ഗണിതകഴിവുകളെ കുറിച്ച് മറ്റുള്ളവർ നല്ലതുപറയുമ്പോൾ അഭിമാനം തോന്നാറുണ്ട്.

34. ഗണിതക്രിയകൾ ബോർഡിൽ ചെയ്യാനുള്ള ആത്മവിശ്വസം എനിക്കുണ്ട്

35. ഗണിതപ്രശ്നങ്ങൾ അഭിമുഖീകരിക്കാൻ എനിക്ക് പ്രയാസമാണ്

36. ഗണിതവിഷയത്തിൽ മികവ് കാണിക്കുന്നില്ലെന്ന് ടീച്ചർ പരാതിപ്പെടാറുണ്ട്

37. ഗണിതക്ലാസ്സിൽ സംശയങ്ങൾ ചോദിക്കാൻ പേടി തോന്നാറുണ്ട്

38. ഗണിതപാഠഭാഗങ്ങളിലെ ചോദ്യങ്ങൾക്ക് ഉത്തരം പറയാൻ കഴിയുമെന്നുറപ്പുണ്ട്

39. പണമിടപാടുകൾ നടത്തുമ്പോൾ എന്റെ ഉള്ളിൽ പേടി അനുഭവപ്പെടാറുണ്ട്.

APPENDIX III

FAROOK TRAINING COLLEGE, KOZHIKODE

SCALE ON MATHEMATICS SELF-EFFICACY

(English-Final)

Dr. NIRANJANA. K.P.
Assistant Professor

NIMISHA THILAK. A
M.Ed.Student

Instructions

The following statements are related to the Mathematics subject. Read each statement carefully and decide to what extent each of the statements is true as far as you are concerned. Choose the one that suits you best from the responses such as Strongly Agree (SA), Agree (A), Neither agree nor Disagree (U), Disagree (D), Strongly Disagree (SD).Your responses will be kept confident and used only for research purposes.

1. I am confident in multiplication.
2. I like to solve difficult mathematics problems.
3. I find it difficult to express my opinion related to maths.
4. I have confidence in winning maths related games.
5. I feel that I am unable to do maths problems without trying to do it.
6. I have less confidence in using watch.
7. I lack confidence in using maths in my future career.
8. I can solve maths problems easily.
9. I have confidence in using maths out of school.
10. I never attempt to perform division.
11. I like to play mathematical games on phone/computer
12. I am not interested to do maths homework.
13. I lack confidence in doing maths problems, as I commit mistakes regularly.
14. I believe that I commit mistake while measuring angles

15. I am confident to ask questions in maths class.
16. I feel fear while preparing for maths test.
17. The lack of progress in mathematics even after working hard makes me sad.
18. I am confident that I can do algebra.
19. I am confident that I can do maths assignments in better ways.
20. I never get higher grades in maths.
21. I am worried when the questions include decimal numbers.
22. I am confident that I am able to work with the compass.
23. I feel stress while thinking about studying mathematics.
24. I have special interest in mathematics projects.
25. I am afraid of errors while using mathematical equations.
26. I am unable to solve maths problems.
27. I will not choose mathematics related area for further studies.
28. I am confident that I can perform well in maths quizzes.
29. I can perform subtraction by mental calculations.
30. I am confident to ask doubts, when I fails to understand the concepts in mathematics class.
31. I can do subtraction without using fingers.
32. I can do addition by mental calculation.
33. I feel proud when someone praises my mathematics skills.
34. I have the confidence to do mathematical problems on the black board.
35. I find it difficult to solve mathematical problems.
36. Teachers complain that I am not good at maths.
37. I feel stressed while asking doubts in maths class.
38. I am sure that I can answer questions in mathematics.
39. I feel tension during money transaction.

APPENDIX IV

RESPONSE SHEET

SCALE ON MATHEMATICS SELF-EFFICACY

Name of the student : Gender: Male / Female

Name of school; Locality of school: Rural / Urban

Type of management of school :Govt /Aided/ Unaided

Qn. No	Strongly Agree	Agree	Un-decided	Disagree	Strongly Disagree
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					

Qn. No	Strongly Agree	Agree	Un-decided	Disagree	Strongly Disagree
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					

APPENDIX V

FAROOK TRAINING COLLEGE
CALICUT

LEARNING STYLE INVENTORY

DR. N.S.MUMTHAS
Associate Professor

YASINAFASI.K
M.Ed student

നിർദ്ദേശങ്ങൾ

നിങ്ങളുടെ പഠനവുമായി ബന്ധപ്പെട്ട ചില പ്രസ്താവനകളാണ് താഴെ കൊടുത്തിരിക്കുന്നത്. ഇവ ഓരോന്നും ശ്രദ്ധാപൂർവ്വം വായിച്ച് അത് നിങ്ങളെ സംബന്ധിച്ച് ശരിയാണെങ്കിൽ (✓) എന്ന അടയാളവും അതല്ല തെറ്റാണെങ്കിൽ (X) എന്ന അടയാളവും ഉപയോഗിച്ച് അതാത് പ്രസ്താവനയ്ക്ക് നേരെയുള്ള കോളത്തിൽ രേഖപ്പെടുത്തുക

1	ഏതിനോടും പെട്ടെന്ന് പ്രതികരിക്കുന്ന സ്വഭാവമാണ് എന്റെത്	
2	ഒരുതീരുമാനം എടുക്കുന്നതിനുമുമ്പ് ഞാൻ പലവട്ടം ചിന്തിക്കാറുണ്ട്	
3	ഏതു പ്രശ്നവും യുക്തി പൂർവ്വമേ ഞാൻ കൈകാര്യം ചെയ്യുകയുള്ളൂ	
4	ഗഹനമായ ഒരു പാഠ്യപ്രശ്നത്തിന് പരിഹാരം കണ്ടെത്തേണ്ടിവരുമ്പോൾ എന്റെ കാഴ്ചപ്പാടാണ് എനിക്കുപ്രധാനം.	
5	ഒരേ കാര്യത്തിൽതന്നെ വളരെയധികം സമയം ഞാൻ ചെലവഴിക്കാറില്ല.	
6	പ്രവർത്തികളിൽകൂടിയുള്ള പഠനത്തേക്കാൾ വായനയ്ക്കു മുൻതൂക്കം കൊടുക്കുന്ന പഠനരീതിയാണ് ഞാൻ സ്വീകരിക്കുന്നത്.	
7	പാഠഭാഗങ്ങളെ നിത്യജീവിതവുമായി ബന്ധിപ്പിച്ചാണ് ഞാൻ പഠിക്കുന്നത്.	
8	ഏതൊരു കാര്യവും ചെയ്ത് കഴിഞ്ഞ് മാത്രമേ അതിന്റെ അനന്തര ഫലത്തെക്കുറിച്ച് ആലോചിക്കുകയുള്ളു.	
9	ക്ലാസ് ചർച്ചകളിലും മറ്റും എന്റെ കാഴ്ചപ്പാട് അവതരിപ്പിക്കുന്നത് വ്യക്തമായി ചിന്തിച്ചതിന് ശേഷംമാത്രമാണ്.	
10	ശരിയും തെറ്റും തിരിച്ചറിയാനുള്ള കഴിവ് എനിക്കുണ്ട് .	
11	ശാസ്ത്രപാഠങ്ങളിൽ നിർദ്ദേശിച്ചിട്ടുള്ള പരീക്ഷണങ്ങളെല്ലാം ഞാൻ ചെയ്തു നോക്കാറുണ്ട്.	
12	പഠിച്ചത് പ്രവൃത്തികമാകണമെന്നത് എനിക്ക് നിർബന്ധമാണ്.	
13	പുതിയതരം അനുഭവങ്ങൾ കിട്ടത്തക്കവിധമുള്ള പ്രവർത്തനങ്ങൾക്കാണ് ഞാൻ മുൻതൂക്കം കൊടുക്കുന്നത്.	
14	ഒരേരീതിയിലുള്ള പഠനരീതിഎന്നെ വളരെയധികം ബോറടിപ്പിക്കാറുണ്ട്	

15	ശ്രദ്ധാപൂർവ്വം മാത്രമെ കാര്യങ്ങളിൽ ഞാൻ ഇടപെടാറുള്ളൂ.	
16	പഠനത്തിനാവശ്യമായ വിവരങ്ങൾ ഞാൻ സ്വയം അന്വേഷിച്ച് കണ്ടുപിടിക്കാറുണ്ട്.	
17	മുന്നോട്ടുള്ള കാഴ്ചപ്പാടോട് കൂടിയാണ് ഞാൻ കാര്യങ്ങൾ ചെയ്യുന്നത്.	
18	ഏതൊരു കാര്യവും ഞാൻ ഒരു നിശ്ചിത ക്രമത്തിലൂടെ മാത്രമേ ചെയ്യാറുള്ളൂ.	
19	പാഠ്യ പ്രശ്നപരിഹാരത്തിന്റേതായ ഒരു പഠനരീതി ആവിഷ്കരിക്കാറുണ്ട്.	
20	സാങ്കല്പികമായി ചിന്തിച്ച് കാര്യങ്ങൾ മനസ്സിലാക്കാനുള്ള കഴിവ് എനിക്കില്ല	
21	വെല്ലുവിളിനിറഞ്ഞ പ്രശ്നങ്ങളെ അഭിമുഖീകരിക്കാൻ ഞാനിഷ്ടപ്പെടുന്നു.	
22	മറ്റുള്ളവർ എന്ത് ചിന്തിക്കുന്നു എന്നറിയാൻ ഞാൻ ശ്രമിക്കാറില്ല -	
23	അംഗീകൃത സിദ്ധാന്തങ്ങളുടെ അടിസ്ഥാനത്തിൽ മാത്രമേ ഒരു പ്രത്യേക കാര്യത്തിൽ ഞാൻ അനുമാനത്തിലെത്താറുള്ളൂ.	
24	പുതിയകാര്യങ്ങൾ കണ്ടെത്താൽ ഞാൻ ശ്രമിക്കാറില്ല.	
25	പഠന സംബന്ധമായ കാര്യങ്ങൾ ഒറ്റയ്ക്ക് ചെയ്തു പഠിക്കാനാണ് ഞാൻ ഇഷ്ടപ്പെടുന്നത്.	
26	വ്യത്യസ്തതലങ്ങളിൽ നിന്ന് ചിന്തിച്ചതിന് ശേഷം മാത്രമേ ഒരു തീരുമാനത്തിലെത്തുകയുള്ളു	
27	ആശയങ്ങളെക്കുറിച്ച് വ്യക്തമായ അറിവ് നേടാൻ വിവിധ മാധ്യമങ്ങളുടെ സഹായം തേടാറുണ്ട്.	
28	ചർച്ചാരീതിയിലുള്ള ക്ലാസുകൾ എനിക്കിഷ്ടമല്ല .	
29	എന്റെ പഠനരീതിയെ ഞാൻ ഒരിക്കലും വിശകലനം ചെയ്യാറില്ല.	
30	തുടർച്ചയായുള്ള പ്രവർത്തങ്ങളിൽ ഏർപ്പെടാൻ എനിക്ക് ഇഷ്ടമല്ല.	
31	ക്ലാസ്സിൽ എടുക്കാൻ പോകുന്ന പാഠഭാഗങ്ങളെക്കുറിച്ച് മുൻകൂട്ടി അവബോധം ഉണ്ടാക്കാറുണ്ട്.	
32	വായന എന്റെ ഹോബിയാണ്.	
33	കൃത്യമായ മുന്നൊരുക്കമില്ലാതെയാണ് ഓരോ കാര്യങ്ങളും ഞാൻ ചെയ്യാറുള്ളത്	
34	വിമർശനാത്മകരീതിയിൽ ഞാൻ കാര്യങ്ങൾ വിലയിരുത്താറുണ്ട്.	
35	പഠനപ്രവർത്തനത്തിൽ കാര്യക്ഷമമായ പങ്കുവഹിക്കാൻ എനിക്കു കഴിയാറുണ്ട്.	
36	എന്തും അർഥം മനസ്സിലാക്കി മാത്രമേ പഠിക്കുകയുള്ളു.	
37	ഒന്നിനെകുറിച്ചും ആഴത്തിൽ പഠിക്കാൻ ഞാൻ ശ്രമിക്കാറില്ല.	
38	ഏറ്റവും അനുയോജ്യമായ ഉത്തരത്തിലെത്താൻ വേണ്ടി എന്റെ ആശയങ്ങളെ പുനക്രമീകരിച്ച് ചിന്തിക്കാറുണ്ട്.	

39	ജിഗ്സോ പോലുള്ള പദപ്രശ്നങ്ങൾ ഞാൻ വിദഗ്ദമായി പരിഹരിക്കാറുണ്ട്.	
40	ബുദ്ധിമുട്ടേറിയ പാഠഭാഗങ്ങൾ പെട്ടെന്ന് തീർക്കാമെന്ന് കരുതി പഠിച്ചു തുടങ്ങാറുണ്ട്.	

APPENDIX VI
FAROOK TRAINING COLLEGE
CALICUT
LEARNING STYLE INVENTORY

DR. N.S.MUMTHAS
Associate Professor

YASINAFASI.K
M.Ed student

Instruction:

Given below are some statements related to your learning. Read these carefully, and mark (✓) if they are right of you and (X) if they are wrong against the column of the concerned statement.

Sl. No		
1	I respond to anything spontaneously.	
2	I think several times before I take a decision.	
3	I deal the problems in a logical way.	
4	I learn through activities.	
5	When I try to find a solution for my learning problem, nothing but my outlook is important to me.	
6	I don't spend much time on one particular matter.	
7	I reach to a consensus by taking into consideration others point of view only.	
8	Learning through reading rather than through activities, is more acceptable to me.	
9	I learn by relating topics to daily life.	
10	I think about the benefits of any matter only after doing it.	
11	I present my view points in the class discussions only after having thought about it clearly.	
12	I have the ability to discriminate between right and wrong.	
13	I do all the experiments suggested in science lessons.	
14	I am very particular in what I have learned.	
15	I give importance to activities which give new experiments.	
16	I prefer learning through discussions.	
17	I try to attain completion to all matters.	
18	I am not interested in basic theories and principles.	

19	I feel much bored by the monotonous learning styles.	
20	I involve in matters very carefully	
21	I learn by myself.	
22	I enquire and find out information for my studies myself.	
23	I accept new information fully.	
24	I do matters with a future perspective.	
25	I don’t discuss learning matters with those who do not think logically.	
26	I do matters only in a fixed/particular order.	
27	To solve learning problems, I adopt my own learning styles.	
28	I don’t consider others instructions.	
29	I don’t have the ability to think/understand matters in an imaginative way.	
30	I like to face challenging problems.	
31	I like to study about areas I don’t know.	
32	I don’t try to know what others think.	
33	I infer only on the basis of accepted theories.	
34	I don’t try to find new things.	
35	I like to do and learn curricular things by self.	
36	I like to indulge in learning activities always.	
37	I am at a decision only after thinking from different perspectives.	
38	I seek aid of different media to gain a clear understanding of concepts.	
39	I prefer learning aids which has practical utility.	
40	I don’t like classes which are based on discussion.	
41	I don’t express my opinions openly.	
42	While taking decisions, I stand firm on that which I feel is right.	
43	More than the product, I give importance to process which leads it.	
44	I don’t reflect my learning styles.	
45	I like theories than learning discovery.	
46	I don’t like to involve in continuous activities.	
47	I try to aware of lessons/topics that are going to be taken in the class beforehand	
48	Reading is my hobby.	
49	I evaluate carefully the information that I receive.	
50	I do each of my activities without clear planning.	

51	I evaluate things carefully.	
52	I listen to discussions in the class with keen interest.	
53	I am able to pay an efficient role in learning activities.	
54	I am not interested in learning by doing activities.	
55	I study anything only after its meaning is understood	
56	I don’t try to study in depth.	
57	I think, rethink and sequence the points to reach at the most appropriate order.	
58	I cannot find more than one way to find solution to learning related subjects.	
59	I am an expert at word puzzles such as zig-saw.	
60	I study difficult topic first.	

APPENDIX VII

LIST OF SCHOOLS SELECTED FOR DATA COLLECTION

Sl. No.	Name of Schools
1	Farook Higher Secondary School, Farook College
2	Zamorin's Higher Secondary School, Kozhikode
3	Government Ganapath Vocational Higher Secondary School, Feroke.
4	Government Vocational Higher Secondary School, Cheruvannur,
5	Venerini English Medium Higher Secondary School,Karinkallai
6	NSS High School, Meenchanda, Kozhikode
7	PMSAPT HSS, Kakkove
8	PKMM Higher Secondary School, Edarikode
9	Govt. Model HSS, Calicut University Campus
10	G.M.V.H.S.S Nilambur
11	Bhavan's Vidyashram Senior Secondary School, Chelembra
12	Islahiya Higher Secondary School in Downhill, Malappuram