Chapter 1

INTRODUCTION

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1.1 Background of the Study

Education brings much covetable intellectual impact to idiosynchronisation in thinking towards the framing of new parameters that governs a powerful future. It provides a solid foundation to seed the multidimensional development of information and communication skills, thinking and problem solving skills, interpersonal and self-directional skills, entrepreneurial skills and self direction to equip the learners to build a good career and leadership in the present globalize scenario. Youdel, (2011) reported that education is a state and societal endeavor with programme of study and recognizable modes of teaching, learning and assessment. As one of the most crucial factors in the development of a nation, education is expected to enrich people with the knowledge and skills to improve their lives and with the values and attitudes to live together. The goal of any education intervention is to ensure that the targeted beneficiaries participate in the programme and achieve the expected literacy and numeric skills, higher order mental skills related to thinking and reasoning abilities; life skills, values and develop emotional intelligence (Sankar, 2010). Our former president Kalam (2002) stated that when the nation is in development mode, one of the most important needs of the country is an integrated developmental plan and empowered management structures in the area of education. He added that our education system should aim to generate enlightened citizens that are a combination of learning and value systems by aligning the human thinking in harmony with the harmony of the universe.

A cursory examination of the realm of education reveals a plethora of issues and concerns associated with the core of current emphasis on educational excellence which provide an ambience of learning that has an international flavor and enables the fruits of research to be disseminated in
society through promotion of robust linkages with economy and civil society. In alignment with modern society’s demands for a more global knowledge based economy, educational ecologies have to undergone structural reforms with a paradigm shift from didactic instructional modes to approaches that are constructivist in character that encourage learners to think in creative and pluralistic ways of pedagogy and gain a repertoire of wide ranging competencies. Undoubtedly we are on the front end of discovering myriad ways to enrich and expand our thinking capacities which will unleash exponentially our ways of doing and constantly aspire for attainment of the pinnacle of knowledge and learning. In today’s accountability driven culture students need a profile of skills not only for managing this knowledge transition but for decision making, problem solving, self direction and self empowerment as they have never needed them before this century. Instead of being arbitrators of knowledge, educators provide contextual strategic scaffolding for learners to engage in automatic processing, dialectical reasoning, divergent thinking and critical understanding. Educational institutions should presumably be an oasis of knowledge generation and pulsars of quality learning churning out solutions of global validity to a problem-ridden world.

Mathematics constitutes one of humanity’s ancient and noble intellectual traditions. It is the pivot of all civilizations and contributing factor in the prosperity of human race. Sinha et al. (2007) reported the words of Bertrand Russell; ‘Mathematics possesses not only truth, but supreme beauty – a beauty, cold and austere, like that of sculpture, without appeal to any part of our weaker nature sublimely pure and capable of a stern perfection such as only the greatest art can show’. Chambers (2010) expressed his mathematics philosophy that mathematical truth is certain, that is incontestable and entirely objective. It is an all embracing and all pervading discipline for all of science and technology, providing powerful
tool for analytical thought and the concepts and language for creating precise quantitative descriptors of the world. Mathematics, as an emancipatory ways that lead to social, political, and or economic empowerment (Friere, 2006) is a dynamic discipline that continues to produce new knowledge. Even nature embraces mathematics. It is regarded as a powerful tool for interpreting the world and therefore should ideally be rooted in real experience across the whole curriculum.

The National council of teachers of mathematics (NCTM, 2000) says that in this changing world those who understand and do mathematics will have significantly enhanced opportunities and option for shaping his/her future. A lack of mathematical competence keeps those doors closed. (As cited by Solomon, 2007).

On the whole, mathematics crept up on humanity made itself at home with no introduction and encouraged us to build our cultural edifice around it (Rooney, 2008). The intuitionist view holds that mathematics is entirely a fabrication of the human mind, constructed to explain the world we find around us but having no existence or validity outside human culture. Even nature embraces mathematics. Quine’s view (Quine, 1098 – 2000) as reported by Rooney (2008) is that mathematics seems to be true because all our experiences and sciences is woven around it and appears to endorse it. It would be very difficult to rebuild our model of the universe without mathematics. It has become common place to speak of mathematics education as essential to a nation to maintain or improve its economic positions in a competitive world. It is said that the future well being of our nation depends on mathematically literate population. Dymoke and Harrison (2008) reported that mathematics is fundamental to national prosperity in providing tools for understanding of science, engineering and technology and for participation in the knowledge economy. The basic
level of mathematics proficiency needs to be raised substantially and the
gaps in proficiency across societal groups need to be eliminated to
participate fully and productively in society and the economy of the 21st
century.

The central importance of the practices in producing a mathematics
learner is stressed in many literatures as a subject who could invoke not
the certainty of absolute power over nature but an omnipotent fantasy over
a calculable universe, a fantasy at the heart of the productive rational
economic man. In this milieu learning of mathematics extends beyond
learning concepts, procedures and their applications. It also includes
developing an intellectual disposition toward mathematics and seeing
mathematics as a powerful way for looking at situations. Dispositions refer
not simply to attitudes but to a tendency to think and to act in positive
ways. Students’ math dispositions are manifested in the way they approach
tasks- whether with confidence, willingness to explore alternatives,
perseverance and interest and in their tendency to reflect on their own
thinking. Hatano and Inagaki (1986) as reported by (Peterson et al., 2010)
opined that students have to acquire in mathematics education is adaptive
expertise- the ability to apply meaningfully learned procedures flexibly
and creatively – as opposed to routine expertise- simply being able to
complete school mathematics exercises quickly and accurately without
understanding.

Mathematics is increasingly a prerequisite for full participation in our
technology oriented society and hence learning of mathematics is
momentous for all from computation skills to high problem solving skill. If
students are to become proficient in mathematics the instructional
dynamism must create opportunities to have layers of understanding about
concepts, learn the procedures meaningfully, solve problems using efficient
strategies, defend and justify their reasoning and engage and challenge mathematical investigations positively. Even though the constructivist approach prevailing in the educational landscape has made a radical revolution in the concepts of learning from dissemination of knowledge to the construction of knowledge, it is observed that mathematics learning scenario is struggling to stretch its arms to the set forth transformation. Learners often confronted with many impediments and challenges to acquire the expected competency in mathematics as it is multifaceted discipline with multi strategic procedures. The investigator as a mathematics teacher educator having an experience of about two decades deemed herself that it is required to empower the learners with many ways to think about the problematic situations, alternative approaches if they get stuck, diverse ways of making progress if they hit blocks, of being efficient with what they know; with certain kind of mathematics dispositions, willingness to tackle mathematical challenges and the tenacity to keep at the task even under undesirable circumstances. The pedagogic dynamisms infused with a culture of reflectivity embrace the opportunity to analyse tasks they have performed or to speculate about how a certain chain of events might takes place under certain conditions and become adept at describing the skills and strategies they use to solve complex problems and apply those in variety of contexts with a transformed perspective. It helps the learners to plan future actions differently in the light of new understanding by promoting transfer of learning, goal setting and planning of strategies maintaining momentum, motivation and sense of relevance. A careful attention in this respect reveals that the state of Kerala, despite the strides made in the realm of mathematics education it possesses certain handicaps in uplifting students to a position of self managed and self responsible learners which is possible through keeping a reflective perspective in every facet of mathematics education.
Reflection takes the form of cumulative body of knowledge and is future focused in that it seeks to improve practice through an understanding of the relative success and failures of previous events maximizing meaning making and self evaluation. It remains connected to past focusing on completed stages. Learners are summoned to revise fundamentally or ordinary ways of conceiving experience, and thus by expanding their vision and by accepting newer forms of thought based on past experiences – the mind is then able to grasp what it was incapable of grasping or accepting before. To be reflective means to wander mentally through where you have been and trying to make sense of it. When reflective practice has been identified as an important component of mathematics education, it provides learners with an opportunity to correct misconceptions and fill in gaps by helping them to think about what they are doing; how they are doing; and why they are doing it. It refines their thinking, improves their thoughts, addresses the roots of their beliefs and assumptions and transforms their practice. Many researchers argue that reflective processes are essential to the quality of learning. Reflection is especially helpful in solving complex tasks, because it helps learners to identify facts, formulae, and theories that are relevant for the solution of an ill defined problem. (King & Kitchner, 1994). Jennifer et al. (2006) have reiterate that engaging in reflection prove beneficial not only for students, but also for entire faculties. The time and effort invested in reflection yield a harvest of greater student learning, higher teacher morale, enhanced feelings of efficacy and a more collaborative professional community. The National Council of Teachers of Mathematics, (NCTM, 2000) calls upon teachers and students to emphasize reflection as part of the process of teaching and learning of mathematics.

Strategies anchored by reflective learning practices invariably elevates thinking and discourses in mathematics from the obvious and
concrete to the implied, abstract and analytical. It empowers the learners with the capacity to raise and solve problematic issues, create new patterns and representations of learning and articulate and network the knowledge repositories. It also opens up avenues for possible investigation and the formation of hypotheses about what the learners know; what they want to know; what they have learnt. This is a place where you challenge the learner to be integrative and pluralistic in approach; to see related concepts and metaphors, where you link the topic to seemingly unrelated topics or personal experience. Eventhough a large spectrum of reflective learning strategies are prevalent in the field of education, the investigator consider a few of them as very effectual in the mathematics learning space.

Research studies exploring the use of learning journals suggest that they have been employed in a diverse array of disciplines to promote students’ capacity for reflection, critical thinking and ultimately, their broader learning (Ballantyne and Packer, 1995a, 1995b; Moon 1999a; Boud, 2001; Henderson, Napan and Monteiro, 2004). Shinic and Jeveremovie (2010) argued that PBL is a student centered instructional strategy in which students solve problems and reflect on their experiences emphasizing critical thinking and problem solving skill with students. The study by Hyerle (2004) has revealed that students engaging in representing their cognitive strategies with visual tools could associate content knowledge easily, activate habits of mind and solve problems effectively.

Thus much has to be changed in mathematics instruction and teachers today must employ the most effective and efficient instructional methods possible for increasing the cognitive involvement of all students with the mathematics curriculum. The learning tasks are to be drafted according to the learner’s conception of the structure of knowledge and their emotional orientations to make them complex thinkers who can
effectively translate issues and problematic situations into manageable tasks that have a clear purpose and enable them to think flexibly. The pedagogical domain in mathematics should be incarnated with innovative and progressive design tools and mechanisms to transform the learners to be active thinkers and problem solvers. Adopting emergent approaches and critical strategies for designing the pedagogical mechanisms of mathematics learning should give prominence within a tightly argued theoretical framework for meeting these challenges. A focused strategic programme of research and development in mathematics education with special emphasis to reflective learning practices can make a meaningful and essential contribution to achieving goals for school mathematics learning programme.

1.2 Need and Significance of the Study

The fifth generation of computing namely cloud computing enables the movement of information technology platforms to the clouds. This fastest growing part of IT in the 21st century is reforming the learning environments and education concepts, because children now live in a world of almost unlimited streams of trivial and profound information of enormous opportunity and difficult choices. The growth of the technology that include worldwide webs requires students to learn not only how to use resources to find relevant information but also how to getting students out in to the world with virtual outreach and excursion in to the physical world getting students into the habit of self reflection. Infusing dynamic, real world contexts into classroom learning will invigorate teacher and student engagement and accelerate the movement of the conception of learning as a set of individual decontextualised cognitive process to a socially organized activity that is inseparable from its socio cultural locus in time and space. Therefore, in this new learning paradigm it requires learners to be able to think reflectively and critically to manage information
accessible via this new pedagogical environment and to become self-authenticated and responsible learners.

To ensure that students develop appropriate skills in addition to disciplinary specific knowledge and understanding, it is the responsibility of the school practitioners to develop learning mechanisms that actively encourage students to become autonomous, independent and self-motivated learners. This in itself requires a paradigm shift in our concept of education from one of providing instruction to promoting effective learners who could strategically confront and creatively resolve the ambiguous paradoxical and dichotomous problems and conflicts they will encounter in the increasingly more complex society. A consequence of this shift is the need to capacitate the students to develop a sense of ownership over their individual learning processes and opportunities for self-assessment and reflection on their achievement such that they as learners can develop a sense of their own personal and intellectual development.

Bound, Keogh, and Weaker, 1985; Kember et al., 1999; Rogers, 2001; Thorpe, 2004 as reported by Bell et al. (2010) claimed that the ability to reflect on one’s learning and to learn from reflecting on experience is a fundamental skill necessary for learning and decision making. They added that developing student’s capacity to engage in reflective practices has been recognized as an essential goal for learning and transformation in higher education and for preparing students effectively for their professional contexts.

An area that has been neglected to some extent in learning of mathematics is an emphasis on learner reflection. This new vision for teaching and learning of mathematics can be fully realized if students are encouraged to reflect on their learning which engraved them with the habits of continuous growth, meaning integration, information rehearsal
and enhanced propensity for learning. Student reflection could act as a proactive way of supporting students’ mathematical development in ways that are compatible with reform recommendations. In the learning and understanding of mathematics students require engagement in conscious reflection on their own mental processes and structures (Gagastics & Patronics, 1990). Indeed the importance of this aspect has been recognized by Krulik & Rudnick (1994) who have applied a reflective approach to problem solving and by Gagastic & Petronics (1990) who have developed a five-stage model of a process of reflective thinking in mathematical activity. It is suggested that the articulation of these pedagogical frameworks is dependent on a classroom culture that provides students with sufficient time to think, reflect and engage in sustained discussion, deliberation and inquiry that challenges, stimulates, encourages and supports skillful and effective thinking.

Literature in the domain of reflection show that new educational practices and techniques such as metacognitive strategies and reflective practices can do affect the learner to gain deeper understanding of concepts, transfer that knowledge to new situations and learn to evaluate their thinking processes they use to arrive at solutions. The teaching learning actions delivered through these strategies emphasize learning by doing and hands on problem solving which encourage them to analyse, interpret and predict information and be supported to foster new understandings based on past experiences. Learners are expected to master the competency and process skills that have shifted away from mechanical computation, rote learning and routine problem practice activities toward an increased emphasis on reasoning, conceptual understanding, strategizing solution paths, posing real world problems and creating perseverance in tackling challenging mathematical tasks. Translating the pedagogical principles associated with the concepts of self-evaluation and reflection on learning into pragmatic
classroom action is a major challenge facing teachers, tutors and educational developers in secondary education. The investigator being a senior teacher educator in mathematics education happened to constantly interact with the present transaction modalities of mathematics curriculum at secondary level felt that the practitioners in this field are foraging for instructional ideas that will assist them to cope with these emerging trends in the mathematics learning space. Thus, the lack of learning design tools for innovative pedagogies of learning namely, experiential, metacognitive and reflective is the lacunae in today’s mathematics learning scenario. Because of the limitations in the availability of proper tools, educational practitioners often use commonly practiced design tools where dynamic and progressive learning activities are desired and hence it does not match the original goals or desired learning out comes. The new learning design tools should be facilitating thinking opportunities, amplifying the meaning of one’s work through the insights of others, enabling students to apply meaning beyond the situation in which it was learned, making commitment to modifications of plans and experimentation, documenting learning and providing a rich base of shared knowledge. This can be achieved by analyzing authentic problems and situating these problems in a staged manner to embark learners into the habit of thinking about their experiences.

Although much rhetoric about reflective learning in mathematics education is there, there are still very few instructional dynamisms of good practice for developing student’s skills in reflection on their learning. In addition, this domain of research with special emphasis to mathematics learning at secondary level, where pupils formulate their learning habits for higher education is sparsely attended in Indian context. Hence the investigator seriously felt the need of the present study that gives a fresh look at reflective learning and locating the students within a theoretical
frame work for learning and explaining the relationship between differentiated classroom practices, to revamp the mathematics learning space at secondary level.

In short, the predicament is that mathematics practitioners have a mechanical instructional design mindset and they inappropriately apply it to newer pedagogies. The core of the problem is that there are new pedagogies but a general lack of alternative learning design tools in mathematics instruction. In this backdrop, the investigator deemed it very essential to develop certain pedagogical designs, which will qualify the secondary school learners with reflective thinking skills ensuing the attainment of mathematics proficiency.

Within this context, the investigator put forward the following research questions:

- How much the strands of mathematics proficiency have been possessed by the students to design their knowledge matrix that enhances their capabilities?
- How can the students at secondary schooling be made to explore new ways of learning mathematics through reflective engagements?
- What kind of reflective learning strategies has the greatest potential to act upon student’s cognitive encounters and emotional orientations in mathematical task engagement ensuring the creation of master problem solvers in a complex world?
- How can mathematics students at secondary schooling be made to drive transformational prioritizing of the sequences of activities accomplished through select reflective learning strategies to attain better results?
Introduction

Chapter 1

How the select instructional frameworks are effected in attaining a reflective mindset subsequently intensifying the upscaling of varied strands of mathematics proficiency among learners at secondary level?

1.3 Statement of the Problem

Individuals who are not proficient in mathematics are cut off from the whole realm of human endeavor, as it is the universal mode of thought and the indispensable segment of all scientific efforts in the Universe. The goal of achieving mathematics proficiency for all students places vastly more ambitious performance demands of pedagogical instruments on all aspects of the educational system. It is observed that the instructional dynamisms rooted in reflective learning practices could energize the mathematics learning space by capacitating learners to configure mathematical concepts, to construct, deconstruct and reconstruct solution strategies and managing mathematical tasks with perseverance. In this stance, the investigator attempted to formulate certain pedagogical frameworks in tune with reflective dispositions in mathematics learning at secondary level of schooling. Based on these observations, review of the related studies and the research questions formulated the present study is entitled, “Developing Certain Designs for Promoting Reflective Learning Practices at Secondary Level”.

1.4 Definition of Key Terms

Design

Design is a harmonious ensemble of strategies for organizing the message, communicating this message to a specified target audience and managing these pedagogical situations optimally. It is a science that involves the crafting of educational material and procedure, aimed at helping learning, with respect to the results expected and the goals of the targeted learners (Distefano, Rudestam & Silverman (2004).
According to Webster’s international encyclopedia (1996) design entails a purposeful arrangement of the element in a creative work or process with an aim to unify function and aesthetics in a harmonious whole.

For the present study, designing entails a harmonious ensemble of descriptors and specifications of different aspects of an instructional environment for generating, transforming and refining a pedagogical mechanism aimed at helping learning with respect to the goals of the targeted learners unifying function and aesthetics.

**Reflective learning practice.**

Reflection is defined as the act of critically exploring what you are doing, why you decided to do it and what its effects have been (Mertler, 2009).

Reflective learning is the process of internally examining and exploring an issue of concern triggered by an experience, which creates and clarifies meaning in terms of self and which results in a changed conceptual perspective (Boyd and Fales, 1983).

Moon (2004) describes Reflection as the purposeful framing and reframing of materials in external or internal experience with an intention in the learner of learning from the process. According to Moon (2004) Reflective learning is a term that emphasizes the intention to learn as a result of reflection and Reflective practice is the professionalized form of reflective learning.

The term Reflective practice was introduced by Schon (1983, 1987) emphasizing the use of reflection in professional or other complex activities as a means of coping with situations that are ill-structured and/or unpredictable.
The present study details **Reflective learning practice** as the intellectually disposed form of learning wherein the learners deliberately and purposefully think to frame and reframe the learning schemata from internal and external experiences through inner dialogues, critical exploration, interactions and communication with oneself and with others for promoting a more complex and innovative mindset ensuing the development of the ability to be self monitoring, self directive, autonomous and to have sense of ownership of their learning.

**Developing**

In the present study developing implies the preparation and testing of reflective learning designs.

**Secondary level pupils.**

The terms refer to the level of schooling providing secondary education that comprises of eighth, ninth and tenth standards of school education. In this study the pupils at ninth standard are referred to as secondary level pupils.

1.5 **Hypotheses of the Study**

The following hypotheses were formulated for the study:

1) The predominant pedagogical functions for transacting mathematics curriculum at secondary school level are inadequate in upbringing mathematics proficiency.

2) The select reflective learning designs are effective in enhancing reflective thinking level of secondary school pupils.

3) The select reflective learning designs are effective in improving the academic performance in mathematics of pupils at secondary school level.
4) The select reflective learning designs are effective in augmenting the set levels of mathematics proficiency of pupils at secondary school level.

5) There is significant difference in the performance among the subgroups of pupils at secondary school level [based on locale and ordinal state of pupils in mathematics achievement and reflective thinking level] with regard to:
   a) academic performance in mathematics and
   b) level of reflective thinking

1.6 Objectives of the Study

The study mainly focused on attaining the following objectives:

1) To analyse the predominant pedagogical functions for transacting mathematics curriculum at secondary school level in upbringing mathematics proficiency.

2) To develop the select learning designs based on the strategies namely, Reflective journaling, Problem based learning and Thinking maps for promoting reflective learning practices among pupils at secondary school level.

3) To test the effectiveness of the select reflective learning designs in enhancing reflective thinking level of pupils at secondary school level

4) To test the effectiveness of the select reflective learning designs in improving the academic performance in mathematics of pupils at secondary school level.

5) To explore the effect of the select reflective learning designs in augmenting the set levels of mathematics proficiency of pupils at secondary school level
6) To compare the effect of each of the select reflective learning designs among the subgroups of pupils at secondary school level [based on locale and ordinal state of pupils in mathematics achievement and reflective thinking level] with regard to:
   a) academic performance in mathematics and
   b) level of reflective thinking

7) To analyse how the select reflective learning designs are effected to intensify the learning of mathematics in the experiential space among certain cohorts of pupils in an interactive set up at secondary school level.

1.7 Methodology in Brief

The present study attempted to empower the student folk at secondary school level with reflective learning practices pursuing advanced mathematics proficiency by developing the select learning designs namely, Reflective journaling design, Problem based learning design and Thinking maps design. For attaining the set objectives of the investigation both quantitative and qualitative methodology were adopted by the investigator for the study. The quasi-experimental design with pre test posttest non equivalent group design was employed for the quantitative segment and semi-structured interview, survey and focus group discussions were adopted for the qualitative segment of the present study.

1.7.1 Sample selected

The sample of the study primarily consisted of 284 pupils at secondary school level coming under three central districts of Kerala namely, Trichur, Ernakulam and Alapuzha. A select sample of experts [N=81] consisted of mathematics experts, teacher educators at B.Ed. and M.Ed. level and school practitioners at secondary school level were
included under the purview of study. In additions to these, six cohorts of pupils at secondary school level from all the experimental groups were taken as the sample of the study.

1.7.2 Analytical supports and techniques of the study.

The analytical supports and techniques employed for the present study were:

1) Interview guide
2) Scale of reflective action
3) Achievement test in Mathematics
4) Analytic rubric for synchronized assessment of mathematics proficiency
5) Lesson design based on Reflective journaling design
6) Lesson design based on Problem based learning design
7) Lesson design based on Thinking map design
8) Strategy evaluation proforma for the select strategies namely,
   a) Reflective journaling
   b) Problem based learning
   c) Thinking maps
9) Focus group ‘questioning route’.

1.7.3 Statistical procedures employed

The statistical procedures employed for analysis of data were:

1) T-test of significant difference between means
2) ANCOVA
3) Adjusted means
4) Predicted quartiles
5) Percentage computations
1.8 Scope of the Study

The prime focus of the study was to evolve certain learning designs for empowering the pupils at secondary school level with reflective learning practices and to test the efficacy of the select designs in purging mathematics proficiency. The effectiveness of the select reflective learning designs was tested with regard to the accrual in the level of reflective thinking and the furtherance in the academic performance in mathematics of the pupils. In the present study the investigator developed learning designs based the select reflective learning strategies namely, Reflective journaling, Problem based learning and Thinking maps. Reflective learning practice is an intentional event in which emotions and cognitions are closely interrelated and interactive and it underpins action learning. The select reflective learning designs are the intellectual landscape of the pedagogical functions; simultaneously requires the students to develop important insights, skills, strategies, dispositions and understanding for continuing learning. The findings of the study announce that the instructional dynamisms stemmed from reflective learning practices could capacitate the learners to acquire skills in self management, self regulation, continuing learning and self evaluation. Though there are certain challenges and restrains in practicing the reflective pedagogy the major benchmarks of the select mechanisms will armed the future learners and teachers to focus for review, reflection, target setting and action planning for future work creatively and to make sense of one’s own experience of learning which involves a wider range issues including goals, feelings, social relations and context of learning. Hence the policy makers, curriculum planners and teachers could frame designs for metacognitive growth which is a means by which students may demonstrate their learning but more importantly involves processes and mode of learning that encourage them to take responsibility for their own continuing learning.
1.9 Delimitations of the Study

Though the present study was conducted in a better comprehensive manner it has got the following delimitations. The practice domain of the study was confined to mathematics learning as the investigator is a teacher educator in mathematics and has have expertise in the same discipline. The selection of the sample of the study was restricted to three central districts of Kerala namely, Trichur, Ernakulam and Alappuzha and to the IXth standard pupils as this sample represents a cross section of the secondary school pupils in Kerala. The investigator developed the select learning designs based on the three reflective learning strategies namely, Reflective journaling, Problem based learning and Thinking maps as she deemed them to be the most effectual and feasible strategies in shaping a reflective culture among the learners. In order to analyse the efficacy of the select designs in practice domains the select cohorts of pupils were selected from high ability subgroups as they could highlight the special features of the design pursuing better performance. Also the experiment was conducted on a single unit namely ‘pairs of equations’ at standard IX as this topic forms the basic mechanism for formulating the solution procedures of all the branches of mathematics.

1.10 Organisation of the Report

The present study is organized as follows:

Chapter I: Introduction

This chapter signifies the background and rationale of the study. It also describes the Statement of the problem, Definition of key terms, Objectives, Hypotheses and Delimitations of the study briefly.

Chapter II: Theoretical Overview

The theoretical milieu of the study is presented in this chapter.
Chapter III: Review of Related Literature

This chapter discusses the pertinent studies and articles that shape the major orbits of the study.

Chapter IV: Methodology

The pathways of the investigation adopted in a comprehensive manner are detailed in this chapter.

Chapter V: Analysis and Interpretation

This section reports the statistical procedures adopted for analyzing the data procured and the relevant results and interpretations emerged.

Chapter VI: Summary and Conclusions

The summary of findings and conclusions derived along with the implications, recommendations and limitations of the study are discussed in this chapter.