Introduction

Learning Science involves in a large part the development of scientific concepts. Beginning with the work of Piaget and subsequently drawing on Vygotsky, the learning of concepts by children has been approached as ‘children constructing knowledge’. What is implied is a process of development and change in the child’s cognitive system represented as schemes and schemas, which occurs through interaction with the world—a physical and socio-cultural environment. The world does not only present the child with phenomena and objects to be interacted with and understood, it also gives concepts and vocabularies as well as people, contexts and practices through which this knowledge and understanding of the physical world takes place.

School in India is recognized as representing a socio-cultural context that is distinct from a child’s home or community (Kumar, 1992). The significance of this distinction from the point of view of the child’s learning is now being explored and written about in research literature (Singh, 1995; Sarangapani, 2003; Khan, 2004; Sharma, 2007). Some of the points of distinction that have been noted include the language of the school vs. home, the school as providing access to ‘modernity’ and the structures of ‘modern society’ as opposed to the ‘traditional’ culture and opportunities of home or traditional societies, the school as a space to access ‘modern’ and ‘scientific knowledge’ as opposed to the everyday commonsensical or superstitious knowledge of the community. These works have begun to explore these two spaces in terms of the contexts for learning they provide.

These studies also suggest to us the disadvantages that accrue to children whose home or community culture differs from that of the school towards the learning of science. Children have to work through the structures and natures of both these cultures and ‘border cross’ between them in the course of constructing school science learning (Aikenhead, 2001; Jegede and Okebukola, 1991). School and home/community background of children play a major role in determining children’s interest, participation and achievement in learning science. School factors such as classroom interactions, pedagogy, nature of curriculum and
instructional materials, learning experiences, examination systems, and home factors such as adult-child interaction, manner of imparting of knowledge to children, societal and parental attitudes, socio-cultural and economic conditions of the family, and resources made available can affect children’s science learning. Any lacunae in these can work towards the disadvantage of children. This is also true in the case of participation and success of the girl child in the learning of science. Gender imbalances in classroom behaviors and interactions, depiction of women in the science textbook, teaching of science—the attitudes, values, content, examples and applications stressed, representation and participation of women in the discipline of science can influence on girl children’s perceptions, self-concept, motivation, achievements and interest in science (Baker, 1998). According to Smolska (1995) when certain groups do not see them represented within scientific culture, they are less likely to choose to participate in the scientific enterprise. The school, science curricular and classroom experiences together with the invisibility of women in the discipline of science in India, absence of their contributions and depictions in science texts and curriculum materials, popular perceptions and as to who is recognized as a scientist can contribute to the girl’s children’s perceptions, participation, interest and achievement in the learning of science.

Science learning experiences can also be difficult for children, when aspects of the children’s community/home culture, worldview, and aspirations come into conflict with that of scientific culture (Cobern, 1996). Science represent a specific culture (Sarukkai, 2003) with a specialized body of knowledge, its own methods, practices, writing strategies, discourses and language that are not immediately apparent to a beginner in science. Science and scientific knowledge production are endeavors conducted within particular social and cultural practices and institution of science (Latour & Woolgar, 1986). Such scientific knowledge can be loosely understood as the cumulative cognitive efforts of generation of scientists. Aikenhead (1996) suggests school science as a subculture of science as the conduct, practices and language of school science are different from that of science.

A science classroom can be understood as a space intersecting between the everyday world of the child, the space of the school (an educational institution with teachers and their pedagogies), and the discipline of science (mediated through curriculum, textbooks and teachers) that constitutes a particular socio-cultural context of learning.
The context of a science classroom is the everyday lived world enacted by teachers and children. It is a complex setting where teaching and learning of science takes place through the interaction of diverse factors such as science curriculum and policy, classroom processes, textbook, the teacher and the learner.

Many of the phenomena which are the objects of interest in the discipline of science are also a part of the everyday world of the child outside the school—its knowledge and discourse. Bridging the worlds of home and school so that they are cognitively in interaction with each other is an important concern of Indian education, as expressed in the National Curriculum Framework 2005.

It is in interaction with the environment that the child constructs knowledge and derives meaning. This area has generally been neglected both in the conceptualization of textbooks and in pedagogic practices. Hence, in this document, we emphasize the significance of contextualizing education: of situating learning in the context of the child’s world, and of making the boundary between the school and its natural and social environment porous. This is not only because the local environment and the child’s own experiences are the best ‘entry points, into the study of disciplines of knowledge, but more so because the aim of knowledge is to connect with the world. It is not a means to an end, but both means and end. This does not require us to reduce knowledge to the functional and immediately relevant, but to realize its dynamism by connecting with the world through it (NCERT, 2005, pp30)

As suggested in the quotation above, the NCF 2005 regards this bridge to be important cognitively, to make school learning meaningful. Further it argues that this is an important arena of reform for equity. The process of education
needs to ensure that children of the poor and from marginalized communities do not experience cognitive alienation which would lead to school learning becoming rote and ritual. For this formal school knowledge and learning needs to be socio-culturally contextualized.

Given these background, this study is an attempt to research into children’s learning of science with a focus on their understanding of scientific concepts, by situating them in a ‘total’ context of science learning i.e. school, science classroom and the social world of the child. The study aims to understand the potential and contribution of the school, the classroom and the everyday world of the child in learning of science and to understand the interplay of social, cultural and cognitive process in development of children’s understanding of science and scientific concepts.

1.1 Learning Science

Learning science in schools attempts to introduce to and induct the child into the discipline of science and the scientific construction of the world (Driver et al., 1994). It involves learning knowledge, practices and language or discourses of the discipline of science (Lemke, 1990). One of the important dimensions of learning science is the learning or acquisition of scientific concepts. It involves the generation of new concepts or the modification of existing ones (Carey, 1985). Scientific concepts can be characterized as containing representation of words, thoughts, actions, objects and processes. One of the ways to examine children’s understanding of science is by examining scientific conceptions that are acquired by children, process/ways in which they acquire these conceptions and the factors that influence the process of concept acquisition.

The process of learning science and the content of science understood by children are topics that received significant attention from researchers (Duit, 2009). Children’s concepts in science have been the subject of research by both cognitive psychologists as well as science educationists. Important developments in this field include the identification of pre-instructional conceptions which children construct and which are different from scientific concepts and the ideas of children as naïve theorizers (Carey, 1986; Driver et al., 1994; DiSessa & Sherin, 1998). Both these insights highlight the ‘active’ character of children as ‘cognizers’. They also emphasize that a large component of science learning in school requires the recognition of the existence of, and
the need for, interaction with ideas which have their origins in pre-and non-instructional contexts.

In the last few decades, researchers began to recognize the significance of social and cultural background of children in the learning of science (Pea, 1993; Tomasello et al., 1993; Sawyer, 2006). The social world of the children is seen to influence learning of science in major ways. Children construct their concepts by a continuous process of interaction between their cognitive system, the physical and cultural environment. Learning science in a classroom is influenced by the socio-cultural context of learning. According to the socio-cultural learning theories, the social context of learning that includes children’s daily life activities, language, and social interaction with adults (parents, teachers, peers etc.) physical and social spaces play a major role in shaping child’s learning (Rogoff, 1998).

1.2 Contextual Approach to Science Learning

The concept of ‘context’ belongs directly in the experienced world. A context is constituted by an activity, persons acting, arenas and settings, structuring of resources and routines of the everyday life of the child (Lave, 1998). The context for learning of science is constituted by the context of the school, science classroom and the everyday socio-cultural world of the child in the background of a science curriculum. It is constituted by the persons acting, activities involved in relation to the structure and setting of the classroom and resources involved. The science classroom can be viewed as a social context in which scientific knowledge is negotiated and constructed (Driver et al., 1994); where teachers and students are positioned with respect to that knowledge. Science learning is mediated through the social interaction and cultural practices of school and science classroom.

The context of science classroom is the everyday lived world enacted by teachers and children. Practices of science institutionalized in the context of school are comprised of teaching and learning, using textbooks, conducting experimental procedures and using scientific apparatus and materials etc. It is constituted of the immediate physical and social aspects of the classroom—setting of the classroom, textbook, writing materials, concrete materials used, mode of teaching, conduction of experiments and activities, participation of teachers and children in the classroom—where teachers and children engage in different daily classroom activities. In the classroom children rely on
knowledge in the form of both non-verbal actions of the science classroom and learning of science from teachers and textbook.

The learning context is also shaped by the goals of the science curriculum and policies, societal and parental aspirations towards the learning of science. The larger socio-cultural setting and informal learning situations surrounding the child—everyday social and physical environment, home and community—parents, siblings, peers, media also influence the learning of science in the context of a classroom.

Another significant component that constitutes context of a science classroom is the language and discourses happening (Moje et al., 2001; Dawes, 2004). Learning science involves not only the acquisition and development of concepts but also the specialized language of science (Mercer et al., 2004). From a socio-cultural perspective on science learning, *language mediates social interaction and scientific knowledge is socially constructed, negotiated, validated, and communicated in the context of the specific discourse practices of science classroom* (Driver et al., 1994). A science classroom prepares children to use the language of science, and way of thinking, and in their understanding of scientific concepts. This involves preparing a learner to use the specialized scientific vocabulary (Sarukkai, 2003) — understanding the words unique to science, words which acquire different meaning when used in science, also learning to read scientific symbols and diagrams and bridging the everyday language of children to the vocabulary, structure, form and genres of science. This occurs through various process and activities of a science classroom, textbook, through the use of instructional tools and processes such as observing, describing, comparing, classifying, analyzing, discussing, hypothesizing, theorizing, questioning, challenging, arguing, explaining, rephrasing, predicting, reasoning, evaluating etc. Thus while learning science children are developing an understanding of scientific concepts along with developing an understanding of language and practices of science that eventually ‘enculture’ children to the culture and practices of science.

Scientific knowledge developed in the scientific community has to be recreated to accommodate to the space and time that exist within the context of a school and science classroom. According to Bernstein (2000) the construction of school science is characterized by a process of change of the context within which meaning of science become operative. Bernstein calls this process as ‘recontextualisation’ by distinguishing between the primary context that refers to the production of scientific knowledge and the secondary context that refers
to the process of its reproduction. Recontextualisation basically involves reconfiguring and reordering existing scientific knowledge so as to retrofit it for a different discursive reality.

In the Indian context the social context refers to a variety of factors and various aspects of the socio-cultural and economic environment in which the child lives. These include the various aspects of the life in the community, the language, socio-cultural resources, physical environment, the family, the extended kin group and community members, the caste hierarchy, the economic conditions, class relations, gender relations, the religious groups, beliefs and practices, social demography of the region etc. The family and home background, educational, occupational and economic backgrounds of the parents, learning opportunities provided by the home, resources available at home, the interaction of the child with other members of the family and attitudes and aspirations of the parents and child towards school and learning are important factors that influence learning and schooling of children.

Science education research, particularly in India, has paid little attention to how science classroom or schooling mediates everyday world of the child/child’s social-cultural resources and learning for scientific concept formation. Recent reforms and innovations in science curriculum and policy documents called on the science educators and teachers to take into consideration the child’s context while teaching science. The influence of the socio-cultural theorizing of learning is evident in National Curriculum Framework-2005 which emphasizes the significance of contexts of learning, child’s environment and socio-cultural background in the process of learning, and home-school relationship. According to the National Curriculum Framework-2005 one of the basic criteria for the validity of a curriculum is its environmental validity which requires placing teaching and learning of science in the local context of the learner’s environment. Also it directs the syllabi and the textbooks to allow space for contextualizing and variations at the local level for all stages of school education. It places child’s community and local environment as the primary context in which learning takes place, and in which knowledge acquires its significance (NCERT-2005).

There is a long tradition of research in the western countries on children’s scientific concepts, and content of science understood by children (Ausubel, 1968; Fensham et al., 1994; Duit, 2009), but the extent of such research in the Indian context is limited. Despite the fact that Indian social reality being distinct from that of these countries, western theories and models have influenced the
scenario of science education in India. The problems confronting Indian schooling and process of science learning have been conceptualized in theoretical terms derived from western research. Also these exert their influence on Indian policy documents, science textbooks, curriculum and classroom, without taking into account the everyday realities of the Indian Science classroom. In this context, it important to systematically examine children’s science learning in an Indian classroom and find effective ways to support students learning, reasoning and knowledge of science.

1.3 School and Everyday Axis

The home, school, and community are the major sites of learning for children from where they acquire a variety of experiences, and construct knowledge. Previous studies suggests that children experience a discontinuity between what is learned at home or everyday life and what is learned at school (Singh, 1995; Sarangapani, 2003; Khan, 2004; Sharma, 2007). Several factors contribute to this difference. The goals and expectations of learning in both contexts are different (Brouwers et al., 2006, Phelan et al., 1991). The manner or procedures employed to impart knowledge and skills, also the language and vocabularies through which learning happens is different. Home learning and school learning also differ in the content of knowledge that they deal with or instill. At everyday/home context children learn under the guidance of parents or family members whereas in schools they learn under the guidance of skilled or trained teachers. In the former context children explore, understand, manipulate and engage with the physical world-materials, objects, and phenomena; they also learn and understand through interactions with other members of the community. Engagement and participation in different social practices in their daily lives outside the school enable children to acquire and develop knowledge in a natural way that these situations provides children with. Indian children, especially in the rural areas contribute and actively participate in the social and economic activities (e.g., agrarian practices) of the community (Sharma, 2007). This equips them with a considerable hold over things and phenomena they encounter in everyday lives outside the school. Children bring in these learning resources and knowledge from their everyday world to the context of a science classroom. School is a structured environment where children are exposed to generalized and abstracted conceptual knowledge and process of various disciplines under the guidance of a teacher. The interactions between teacher and children, and those among children are important in the construction of knowledge in the
social context of the school. “Schooling is a setting where teachers and pupils cooperate to elevate pupils’ degree of generalization. This “cooperation” is motivated by the perception that generalization offers to children an opportunity to recognize new problems as requiring the application of previously-acquired cognitive rules, an advantage in the processing of cognitive problems that cannot be achieved with unique rules for each new problem” (Brouwers et al., 2006). Student’s movement and transition from the context of the home/everyday to that of the school requires specific efforts and skills from the child as these are contexts that are governed by different values and norms. Children’s competence in moving between these setting is one of the major determining factors of school success (Phelan et al., 1991)

1.4 The Present Research

The present study examines middle school children’s science learning on the axis of school and everyday. It examines middle school children’s learning of science with a focus on their understanding of scientific concepts by situating them in a ‘total’ context of science learning i.e. children’s home and everyday world context, the context of the school and science classroom processes. It investigates the children’s experience of curriculum, textbook and pedagogy, the development of their understanding of science, and their understanding of the concept of matter. The research directs itself to three broad dimensions of the problem. Firstly, the curriculum and the textbook, secondly the classroom; and thirdly, the child’s conceptions and learning. These are situated within the larger socio-cultural context of the school and community from which children come.

The basic framework for this study is built on the socio-cultural approach to learning. The key idea in this approach is that individual thinking is constituted by social interaction and cultural practices and that the individual must be seen and understood integrally in relation to the social (Vygotsky, 1978). Teaching and learning are to be understood as taking place in a socially created setting and involving participation in a ‘community of practice’ (Lave, 1988). This draws attention to the dimension of language, social interaction, tools and context in cognition. This basic framework has been expanded by including the approaches of cognitive studies and science education. The cognitive perspective is concerned with an individual child’s understanding of particular concepts. It draws attention to and draws upon conceptual analysis of the concept and an in-depth investigation
into individual children’s conceptualization through the method of clinical interviewing. The science education perspective has an interest in drawing out and developing pedagogical insights and implications. The three approaches are not mutually exclusive, and draw upon and build on each other.

The socio-cultural contexts which are of particular interest in this study include the ‘school’ and the ‘out of school’ — the home, community and everyday life of the child.

1. **The school and classroom** are two major sites of pedagogical processes and dominant contexts of learning. This is where the teaching and learning of science happens, encompassing the school culture, classroom process, science curriculum, teacher, textbook, learning materials, peers and language in which teaching and learning of science happens.

2. **The everyday world (social, cultural and physical) outside the school** includes the community, members of the community, the language, the family and home background, occupation and skills of the parents and members of the community, physical and social spaces children can access, the local environment of the child, personal experiences and observations of objects and events in the environment.

The socio-cultural perspective proposed here attempts to address the significance of child’s school and everyday worlds, their social, cultural and physical world, in the learning of science. It takes into account the child’s experience in a science classroom against background of children’s lived experience outside the classroom. Aikenhead (2001) considers this process as students crossing cultural borders from the subcultures of their peers and family into the subculture of science and school science. The basic approaches on which the study is built—cognitive, socio-cultural and science education—are discussed in more detail below.

1.4.1 Cognitive Perspective

One of the important components of learning science is the generation of new concepts and the modification of the existing ones. One of the approaches to study mechanisms underlying scientific cognition is to investigate the concepts that children and adults hold in various topics in science; where the focus is on conceptual development or conceptual change (Carey, 2000). Examining
children’s acquisition of scientific concepts can throw insights into questions regarding scientific cognition and understanding the nature of the human mind. This approach has its origins in the pioneering work of Bruner (1956) who argued that a key activity that scientists engage in is determining whether or not a particular instance is a member of a category.

Scientific concepts, like all concepts can be characterized as containing representations of words, thoughts, actions, objects and processes (Sutton, 1992). Thus, the process by which human beings and children cognize science can be better understood by examining the ways in which they acquire these categories of words and objects in science. Concepts serve two critical functions: they are an efficient means of representing and storing experience and they help children to extend knowledge and learn about the world by means of inductive inferences (Gelman & Kalish, 2006). Thus by studying children’s conceptualizations we learn about the children’s representation of experience and about reasoning by induction, most importantly the content of children’s knowledge of science.

1.4.2 Socio-cultural Perspective

The socio-cultural perspective proposed here addresses the significance and role of children’s social, cultural and physical world in the learning of science. From a social constructivist perspective, the learner is viewed as part of community and learning is viewed as process that occurs as individuals interpret their experience in particular contexts, including interactions with others (Vygotsky, 1978; Kozulin, 2003; Valisner, 2008). Vygotskian and neo-Vygotskian perspectives of social constructivism claim that social interaction is the main shaper of scientific knowledge in children. Teaching and learning takes place in socially created settings and it involves participation in a community of practice. Social interactions direct and mediate knowledge construction through the communication of expressions, actions, and use of written and oral language (Daniel, 2001). Children construct meaning about phenomena outside formal schooling from social interactions with more knowledgeable individuals—adults, siblings, and peers.

Examining children’s learning of science from a socio-cultural perspective requires approaching learning from the multiple interacting aspects of the learning environments — the kinds of learning activities, the material and social resources for learning, the roles that learner takes on, the knowledge distributed within social networks and the practices for exchanging information (Solomon, 1987).
Also examining cognitive activity in context means not only considering the place where activity occurs, but also considering how context, the meaning that the place and the practices have for the participants, is socially constructed. It explores the relationship between the person and the social environment, and the conditions under which they exert reciprocal influence.

According to Vygotsky (1987), concept formation should be approached from two levels – the everyday and scientific. Everyday concepts are formed through the interactions and experiences encountered by the child outside formal school settings and are grounded in the day-to-day life experiences of children. They centre on the phenomena being represented, are based on the physical appearances and characteristics of the phenomena; thus perceptually bound (Shepardson, 1999). They are based on particular instances and are not part of coherent system of thought. On the other hand scientific concepts are those learned in school and learned as part of a system of relationships. Scientific concepts are formed through the functional use of the word or any other sign as a means of focusing one’s attention. They are not directly tied to the phenomenon or object and are defined in a generalized fashion. They are systematic, hierarchical knowledge as opposed to the nonsystematic, unorganized and context bound knowledge gained from everyday experience (Wells, 1994). Everyday concept formation and scientific concept formation are strongly connected to each other as everyday concepts lay the foundation for learning scientific (or academic or schooled) concepts. Adults create the potential for the development of scientific concepts in the context of more formal school experiences. When children simply learn scientific or academic concepts at school away from the context in which they are used, understanding of such scientific concepts may be limited to abstract thinking.

1.4.3 Science Education Perspective

Science education research is concerned with the broader questions of learning the discipline of science—theory and method, and the mechanisms underlying children’s understanding of scientific concepts. The components of science curricula are designed to build up concepts in a logical sequence and expose students to scientific phenomena, theories and experiments that give students practice in using these concepts (Palmer, 1999). To effectively design a science curriculum, choose content and instructional practices, and to promote children’s science learning, it is essential to understand what children think about science,
scientific concepts and why they think those ways. It is also important to understand the manner in which children learn science, trace children’s learning difficulties in science and whether the source of intrinsic difficulty in learning science is the conflict between the two conceptual systems-intuitive or concrete concepts acquired from the everyday world and abstract or generalized concepts acquired from the school. It is to be investigated whether we should accept the two conceptual systems, intuitive gained from experience and scientific gained from class room as two parallel cognitive worlds for learning science.

1.4.4 Aims, Objectives and Research Questions

The study aims to provide understanding regarding the development of children’s concepts in science, with special focus on school and everyday world as contexts of learning. It tries to analyze how science curriculum, syllabus, textbook, teachers and instructional strategies define and deal with the teaching and learning of science concepts and the address the question of ‘context’. The significance of this particular study lies, in the insight that it can provide into conceptualizing ‘socio-cultural context’ in a manner that enables it to be factored into developing choice of content and instructional strategies in science curriculum. Given the significance of the issue of ‘socio-cultural context’ and ‘environmental validity’ to Indian school curriculum, such a systematic study of curriculum, classroom and children’s understanding focusing around a single concept, could generate useful insights.

The research is structured around the following three questions:

I. What are the constitutive elements of the ‘everyday’ (‘social’ and ‘cultural’) which are significant in relation to the process of teaching and learning of science? What are the elements of social and cultural contexts within and outside the schools and how do these aspects of the child’s life interact with their learning at school? How do we theorize the character and consequences of school-home/ everyday differences that exist for the learner from the point of view of learning?

II. What is the structure and what are the characteristics of the pedagogies that children experience in the science classroom? How do the official curriculum, pedagogic prescription and choice and organization of content approach the question of contexts of learning and the worlds of school and everyday? And to what extent do they frame and control the activities of teachers themselves?
Choice of a focus on the concept of matter leads to the following additional questions:

III. What is the treatment and approach given to the concept of matter in the textbook and classroom? To what extent does this draw upon and involve the child’s everyday experience of matter and everyday language? What are children’s understandings of the concept of matter? What is the nature and structure of children’s science concepts?

1.5 Methodology in Brief

The methodology principally uses qualitative research methods and techniques. The study requires studying the field and the children at various levels: the context of the larger social life of the child outside the school, the nature of the school experiences, science learning process and the mind of the child. The appropriate tools for the study were drawn from the ethnographic tradition-field work, participant observation, interview and Piagetian Clinical Interview. The tools were chosen in such a manner that they could provide holistic understanding of children’s concepts in the backdrop of their social-cultural background and the context of learning. The study also analyzed the presentation of the concept of matter in the science textbook and the usage of and depiction of everyday vs. scientific concepts. Clinical interviews were conducted around seven tasks, involving handling materials and writing that were designed to explore various aspects of the concept matter. A classification task was performed in the context of the school and home. Eighty seven children (41 boys and 46 girls) from four grades (V, VI, VII and VIII) were studied in detail. The task explored the children’s conceptions of matter: states of matter and change of state, properties and constituents.

1.6 Choice of the Concept ‘Matter’

The concept of matter was chosen for focus. Development of concept of ‘matter’ is one of the fundamental aims of the school science (Smith, Grosslight & Davis, 1997). Appropriate understanding of matter is essential to understand the principles and theories of physical and chemical changes. The concept of matter is a central concept in the middle school science lessons, also it can be related to the everyday world of the child, and i.e. it is a concept with explanatory power both in and out of the school. The everyday world of the child is filled
with a variety of material objects from which children develop their initial conceptions of matter.

Selecting the concept matter allowed the study to probe ways of understanding of a specific science concept by children. The concept ‘matter’ progresses from concrete to abstract from the primary to high school science textbooks; from properties of matter-states-pure substance and mixtures-elements and compounds-physical and chemical changes to atomic structure. Feynman outlines the significance of concept ‘matter’ as follows:

“If, in some cataclysm, all of scientific knowledge were to be destroyed, and only one sentence passed on to the next generations of creatures, what statement would contain the most information in the fewest words? I believe it is the atomic hypothesis (or the atomic fact, or whatever you wish to call it) that all things are made of atoms—little particles that move around in perpetual motion, attracting each other when they are a little distance apart, but repelling upon being squeezed into one another. In that one sentence, you will see, there is an enormous amount of information about the world, if just a little imagination and thinking are applied (Feynman, Leighton, & Sands, 1963, p.2)”

1.7 The Location: Kerala

The field chosen for the study was a village school in the state of Kerala. Kerala is internationally known for its high levels of literacy and overall human development indices. A strong system of government schools characterized the school education scenario. Kerala as a location is significant from the point of view of this study as it provides a new dimension to the question of context. The period of my field work at Kerala, from September 2006 to May 2008, was an interesting time in Kerala’s school educational scenario, when a systematic effort was made to redefine the school education in terms of a social constructivist curriculum. The Kerala State Board introduced several changes in the schooling process in terms of the curricular approach, classroom practices, pedagogic methods, textbooks and teaching material, teacher training and empowerment, new evaluation methods and community participation in the school system. These reform processes were initiated under District Primary Education Program and continued under Sarva Shiksha Abhiyan. The important aspects of these changes has been a major curricular revision, its focus on decentralized and participatory planning where the community link to schools and devolution of power to panchayats were expected to improve the quality of education; also to encourage
learning through the use of resources of the environment and the community. The programme of curriculum revision was supported through the development of new textbooks, handbooks for teachers and a course of in service teacher training workshops for teachers, to be conducted and supervised by the block and cluster resource centers. The new curriculum introduced a learner-centered, activity-based and process-oriented pedagogy and adopted a scheme for comprehensive and continuous evaluation. The new approach recognized the child’s own active role in the learning process and emphasized teachers as the facilitators of this process. The new curriculum and pedagogic process reached the school and classroom through rigorous teacher training program, teacher handbooks and active participation of various institutions such as SCERT, DIET, BRC, CRC, local community and teachers in planning, educational management and implementing the programmes. The state also has a long engagement with a people’s science movement through the Kerala Sastra Sahitya Parishad (Tharakan, 2003). A large proportion of the cadres of KSSP are drawn from among teachers. With the advent of the District Primary Education Project in selected district of Kerala, in the year 1996, the involvement of KSSP in school curriculum was initiated and its influence began to be felt in elementary school curriculum and pedagogy. Rewriting of textbooks along with the establishment of Cluster and Block resource Centers for in-service teacher education and school support was an important component of the DPEP in Kerala.

1.8 Organisation of Thesis

The first chapter of this thesis presented the background of concerns in science education in general and in Indian school education in particular in which it located the research problem. The research problem and the theoretical position through which this problem is addressed were introduced. The study aims at evolving a situated understanding of learning science in general and in learning the concept of matter in particular, with a special interest in the curricular problematic of the everyday world vs. the world of school. The chapter also discussed rationale for conducting this study: aim, research questions, significance. The chapter argued for the need to study children’s scientific conceptions by taking a socio-cultural situated approach to learning. A framework was proposed to study children’s scientific conception that bridges the domains of science education, cognitive and cultural psychology. The chapter also discussed the significance of conducting such a study in an Indian classroom where children from heterogeneous backgrounds study science according to a
common curriculum. Three groups of research questions were identified and delineated. The first group related to the conceptual categories of ‘context’, ‘school and everyday worlds’ as cognitive and curricular concerns. The second group was to do with the curriculum and pedagogy of science education that children experience. The final group was to do with children’s understanding and conceptions.

Chapter Two is directed at locating the study in related literature. The purpose of this chapter is to provide a basic unifying framework and develop two key concerns that are the important focus of this study. The first is the cognitive/constructivist framework developed in a manner that enables us to engage with children’s learning of scientific concepts and contexts of learning. This is elaborated to perspectives and discusses major aspects of science education in the Indian scenario in the second section of the chapter. A few significant studies that have taken place in the Indian context are reviewed. The third part of the chapter examines and reviews the constitutions of and dimensions of the issue of everyday vs. school as it has been constituted and addressed in Indian education, historically, in the space of action (science curriculum and people’s science movements) and in policy. After presenting key ideas of these frameworks, the final section of the chapter presents an approach that informs this study and the consequent sharpening of research questions.

Chapter Three discusses the research design and methodology employed for the study. Initial section explains the methods used to study child’s conceptions of matter taking into account of the social-cultural dimension of learning. The school and everyday as contexts of learning are factored into the study by paying specific attention to the context of learning (the school and everyday).

Chapter Four introduces the field chosen for the study- the village and the larger context of the social life, the school, the features of the schooling processes in the context of Kerala and the chosen field site. It also presents aspects of the socio-cultural context of Kerala that contribute to the formation of an approach to science education that is evident in the curriculum.

Chapters Five to Seven present findings. Chapter Five presents understanding emerging from the curriculum and textbook. Chapter Six is devoted to the space of the science classroom. Chapter Seven present children’s understanding as evidenced from tasks and clinical interviews. These chapters dwell on the similarities and differences between the everyday world, school
world and the discipline of science—in the aims, purposes and processes through which ‘science’ and the material world are viewed, approached, categorized and nominalized.

Chapter Eight provides an overview of the key findings of this thesis and dwells on the contributions it makes in furthering the project of making science education a meaningful and contextualized experience for children in India.

1.9 Summary

The chapter provided the background for the research study, locating it in the Indian curricular concern to bridge the gap between the everyday world of the child and the world of the school. Children’s learning of school science can be problematised with the help of the cognitive, socio-cultural and science education perspectives. This involves examining following components of science learning

(a) the subject matter or the concept under consideration
(b) the curriculum and textbook
(c) the contexts of learning-the school and the social milieu
(d) the classroom processes

The cognitive perspective focus on the understanding, explanations and learning of the concept matter build by individual child. Socio-cultural perspective gives attention to the influence of social milieu of knowledge construction. Science education perspective focus on ways to enhance child’s meaningful learning and understanding of scientific concepts/principles, make science learning relevant for the child, and application of what is learned in the classroom to everyday problem solving situations.