CHAPTER VII

SUMMARY AND CONCLUSION

7.0 Introduction
The future of the world depends largely on the wisdom with which human use science and technology. This is, in turn, depends on the character, distribution, and effectiveness of the education that people receive (Kemal & Oguz, 2007). The problems of the world in different domains increase its complexity which requires collective action. Education being an influential subsystem of society needs to change its role from preparing a better individual to group of individuals who can work together to solve emerging and future problems. But when we look at Indian education system, the existing practices of education in school and universities, knowledge is presented as primordial and no more relevant to address new age requirement. This demands a paradigm shift in education system from knowledge transmission to knowledge construction. It requires the change in role on the part of the teacher and learner in teaching learning process. In this context constructivistic approach viewed as a suitable pedagogy for today’s classroom setting.

Theoretical framework

7.0.1 Constructivism in Education
The new paradigm, “constructivism,” is a psychological philosophical perspective contending that individuals form or construct much of what they learn and understand (Shunk, 1996). It is a descriptive theory that highlights the way people learn or develop rather than the way they should learn (Richardson, 1997).

7.1 Guiding principles for constructivist classrooms
In a constructivist classroom, the teacher searches for students’ understandings of concepts, and then structures opportunities for students to refine or revise these understandings by posing contradictions, presenting new information, asking questions, encouraging research, and/or engaging students in inquiries designed to challenge current concepts. The following five overarching principles are evident in constructivist classrooms.

- Teachers pose problems of emerging relevance
- Teachers build lessons around primary concepts and “big” ideas
- Teachers seek and value their students’ points of view
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- Classroom activities challenge students’ suppositions
- Teachers assess student learning in the context of daily teaching

7.2 Becoming constructivist teachers: descriptors

To become constructivist teacher one need to adopt certain set of teaching behaviour in his / her teaching. The descriptors are:

- Constructivist teachers encourage and accept student autonomy and initiative
- Constructivist teachers use raw data and primary sources, along with manipulative, interactive, and physical materials
- When framing tasks, constructivist teachers use cognitive terminology such as “classify,” “analyze,” “predict,” and “create.”
- Constructivist teachers allow student responses to drive lessons, shift instructional strategies, and alter content.
- Constructivist teachers inquire about students’ understandings of concepts before sharing their own understandings of those concepts.
- Constructivist teachers encourage students to engage in dialogue, both with the teacher and with one another.
- Constructivist teachers encourage student inquiry by asking thoughtful, open-ended questions and encouraging students to ask questions of each other.
- Constructivist teachers seek elaboration of students’ initial responses.
- Constructivist teachers engage students in experiences that might engender contradictions to their initial hypotheses and then encourage discussion.
- Constructivist teachers allow wait time after posing questions.
- Constructivist teachers provide time for students to construct relationships and create metaphors.
- Constructivist teachers nurture students’ natural curiosity through frequent use of the learning cycle model.

These twelve descriptors highlight teacher practices that help students search for their own understandings rather than follow other people’s logic. The descriptors can serve as guides to educators forge personal interpretations of what it means to become a constructivist teacher.
7.3 Constructivism: Implication to teacher education

The key implication of the constructivist paradigm for teacher education is that student teachers should have time and encouragement to reflect on what they are learning. Because of the short duration of pre-service programs there is a tendency to think we must “give them the theory” while we have the chance, leaving them to work out the implications as they teach. This is an unfortunate approach, however, not only because it models transmission pedagogy but because it gives the students inadequate opportunity to assess and adapt theory (Fosnot, 1989; Tom, 1997; Wideen & Lemma, 1999). Fosnot (1996) maintains that, to achieve a constructivist teacher education program, field experiences must take place in settings that are conducive to experimentation and in which curriculum is approached “in an integrated, learner-centered fashion with emphasis on learner investigation, reflection, and discourse”.

7.4 Common methods and strategies used in Constructivistic Approach

The common methods and strategies used in constructivistic approach are:

7.4.1 Cooperative Learning

Johnson, Johnson, and Holubec (1993) define CL as “the instructional use of small groups so that students work together to maximize their own and each other’s learning”.

7.4.2 Collaborative learning

Collaborative learning is an approach to teaching that is built on philosophical positions like Dewey's, Vygotsky's, and Habermas', which assert that knowledge is socially constructed within a community of learners. If knowledge is socially constructed in learning communities, an important feature of any method of teaching within this framework is to promote meaningful dialogue among students. Cooperative learning’s origins in a concern that competition can impede learning, collaborative learning began with a concern that the hierarchical authority structure of traditional classrooms can impede learning.

7.4.3 Problem based learning

Problem Based Learning (PBL) stresses the use of real-life problems as a stimulus for learning. In PBL, students work in small groups on these problems, and, in the course of discussing them, formulate goals for self-directed learning. The learning resulting from
these activities is constructive and contextually meaningful. Students using PBL build teamwork skills as they learn from each other and work together to solve the problem. The PBL process generally includes four main steps: (1) introducing the problem, (2) exploring what students do and do not know about the problem, (3) generating possible solutions to the problem, and (4) considering the consequences of each solution and selecting the most viable solution.

7.4.4 Inquiry learning
In Inquiry learning, the teacher poses question and then allows time for the students to consider possible solutions, plan an investigation, and go about solving the question posed to them. It helps students focus on the development of key skills such as hypothesis development, planning procedure for activities, data collection, data analysis, and drawing conclusions. In the classroom, inquiry-oriented learning can take many forms. As the teacher, one can help scaffold and build upon the inquiry process by assisting and encouraging students to ask questions related to the topic being investigated. Students then have the responsibility to identify and define their own individual procedures for answering these questions to make the content personal and meaningful to them.

7.4.5 Field Visits
A field visit enables the learners to experience materials and phenomena in their true and natural relationships. They can observe real conditions and gather actual data. Studies have shown that more education can be acquired in a pleasant outdoor environment than in the classroom. It provides an opportunity for learners to become keen observers, appreciating the beauty and order of the natural environment. It verifies classroom instruction and laboratory exercises.

The present study focuses on constructivistic approach to Environmental Education using all the above mentioned methods. Because there is growing concern about the state of the environment, and at the same time we are very often confused by the complexities of economic, ethical, political, and social issues related to it. Environmental problems become everyday news in our media.
7.5 Environmental Education: Meaning and Definitions

In general Environmental education is, forming desirable belief, attitude, value, interest and understanding about environment. While understanding the meaning of environmental education three of its connotations i.e. education about, education through and education for the environment are implicit in the meaning.

Education ABOUT environment means making environment a subject of investigation. It is based on a specific topic or a restricted area in which the main concern is to gain information and comprehension. It can be done in the classroom as well as in the field.

Education THROUGH environment usually connotes using environment as a medium for study, the use of real life situations as the basis for learning and enquiry. It is essentially an approach or method of enquiry usually conducted through field work.

Education FOR the environment means education for conserving and improving the environment, a study of environmental problems and working for their prevention and solution. Problem solving, decision making, development of an environmental ethics and critical judgment are called for here. Commonly accepted definition of environmental education is: Environmental education is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution (Gigliotti, 1990).

7.6 Goals of Environmental Education

The overall goal of environmental education is to generate environmental action so as ‘to improve all ecological relationships including the relationship of humanity with nature and people with one another’ (Belgrade Charter, 1975). The Tbilisi Intergovernmental Conference on Environmental Education (1977) elaborated the goals of environmental education as the following: to foster clear awareness of, and concern about economic, social, political and ecological interdependence in urban and rural areas; to provide every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment; and to create new patterns of behaviour of individuals, groups and society as a whole towards the environment.
7.7 Objectives of Teaching Environmental Education

The Belgrade Charter has suggested the following six objectives for teaching environmental education.

*Awareness:* To help individuals and social groups acquire an awareness and sensitivity to the total environment and its associated problems.

*Knowledge:* To help individuals and social groups, acquire basic understanding of the total environment, its associated problems and humanity’s critically responsible presence and role in it.

*Attitude:* To help individuals and social groups, acquire social values, strong feelings of concern for the environment and motivation to actively participate in its protection and improvement.

*Skills:* To help individuals and social groups, acquire the knowledge and skills of solving environmental problems.

*Evaluation Ability:* To help individuals and social groups, evaluate environmental measures and educational programmes in terms of ecological, political, economical, social, aesthetic and educational factors.

*Participation:* To help individuals and social groups, develop a sense of responsibility and urgency, regarding environmental problems to ensure appropriate action for solving the problems.

7.8 Guiding principles of Environmental Education

The Tbilisi Declaration, a document resulted from this conference, outlined the following guiding principles for environmental education.

Consider the environment in its totality – natural and built, technological and social (economic, political, technological, cultural historical, moral, aesthetic); Continuous, lifelong education process beginning at pre – school stage and spanning the entire stages through all formal and non – formal systems of education. Inter – disciplinary in its approach, drawing from various branches and integrating into a holistic and balancing perspective. Environmental issues are examined from local, regional, national and international perspectives and students receive insight into the environmental conditions and problems in global contexts. Promote proper values and attitudes and the need for cooperation of local, national and international bodies in the prevention and solution of environmental problems. Develop environmental sensibility, knowledge and problem solving skills among the students.
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Assist learners to discover the symptoms and real causes of environmental problems and arrive at strategies for environmental protection and preservation.

Utilize environmental resources for teaching – learning processes and evolve educational approaches for teaching and learning with due emphasis on practical first hand empirical experiences. Emphasize the complexity of environmental problems and develop critical thinking and creative problem – solving ability in order to deal with complex environmental problems (NCERT, 1985).

7.9 Need of effective teacher training for Environmental Education

To Indian school system, Environmental Education (EE) is not altogether a new thrust. Educating children about, through and for the environment have always been stressed by earlier national commissions and committees. However, it was only during 1986, that a special focus was made in the country’s New Policy on Education. The Policy States that “There is a paramount need to create a consciousness of the environment. It must permeate all ages and all sections of the society beginning with the child. Environmental consciousness should inform teaching in schools and colleges. This aspect will be integrated in the entire educational process”. The National Curriculum Framework for School Education (NCFSE) 2000 (NCERT, 2000) also highlights the need for including environmental concerns at all the levels of schooling. It asserts the Fundamental Duties (Article 51 A of part IV A of the Indian Constitution): "...protect and improve the national environment including forests, lakes, rivers, wildlife and to have compassion for the living creatures... “(Common Core Components, p.36). As one of the General Objectives of Education, it mentions "understanding of the environment in its totality, both natural and social, and their interactive processes, the environmental problems and the ways and means to preserve the environment" (p.40).

In consonance with these documents, environmental studies was made an independent subject at the primary level and topics related to environment were suitably infused with different science and social science subjects at all school stages. As a sequel to this explicit policy statement, efforts have been made in the country to introduce EE in school education through reorganizing the content and methodologies of teaching. At the lower primary stage, i.e., up to class V, EE is introduced as integrated themes anchoring concepts of both natural and social phenomena. In Classes VI – X, Environmental Education has been integrated suitably in social sciences, languages and science and
technology. The objectives at this stage are to help the children appreciate the contributions of scientists and develop sensitivity to the uses and misuses of sciences, as well as concern for a clean environment and preservation of the ecosystem. Environmental Education is infused into the teaching of other schools subjects like mathematics, crafts and work experiences, and languages.

It is a reality that a high percentage of teaching force at the school level suffers from environmental illiteracy – illiteracy in terms of lack of understanding of the gripping environmental issues the country is facing, the methodologies of teaching – learning for infusing EE in to the school curriculum (Ravindranath, 1997). Teachers need to plan for projects and activities for students’ participation in environmental problem – solving. This necessitates equipping teachers with necessary knowledge, attitudes and skills for the effective implementation of EE at the school level.

Realising the above need, the country has made several attempts in introducing EE as one of the thrust areas at teacher training level, and environmental education became a prominent component in in - service training programme. But, it is impossible to achieve all competencies within a single education programme. In this context, pre – service training of teachers is of paramount importance. Recommendation 17 of the Tbilisi Conference emphasizes the pre-service training of teachers. Competent teachers do not emerge out of the blue. They must acquire and practice the attributes of competency and skills during their education. Teachers education colleges should, therefore, review their teacher education programmes in the light of the philosophy of environmental education.

7.10 Importance of Constructivist Approach in Environmental Education at pre service teacher educational level

Environmental Education requires less focus on training and more focus on developing wisdom and flexible applications of diverse problem solving strategies. The teachers in classroom not just supply information, but make the student to understand the role of the individual in environmental problems and what alternatives and / or actions are necessary to solve such problems. It is important that the problem / issues of environment in EE should engage students with real life issues and reinforce the notion
that scientific facts must be accumulated and analysed in social and cultural contexts in order to make valid value judgement.

The teaching methods and styles which environmental education requires is constructivist, student directed and experiential in orientation. Successful EE demands an in-depth environment related content knowledge and ownership (responsible environmental behaviour) (Hungerford & Volk, 1990). This can be achieved through constructivist based learning. Learning activities in constructivist settings are characterized by active engagement, inquiry, problem solving, and collaboration with others.

Constructivist approaches provides risk free environment for the learner in the classroom and teachers’ role as a facilitator further helps learners own thinking which lead to the sense of ownership. This helps students interest, enthusiasm, and satisfaction towards learning. The training of environmental education and field experience helps teachers to have better environmental literacy and better conceptual understanding. Along with the environmentally literate teacher, if the schools have better infrastructural facilities further facilitate students’ achievements in environmental education. Through constructivist based pedagogical approach student express their personal beliefs and multiple perspectives on environmental issues and perform well in their exams. From the review of related literature it is observed that there are very few studies conducted on constructivism and environmental education in teacher education. Further, pedagogical demands of environmental education go well with the constructivist methods. So it is necessary to conduct research on constructivist approach to environmental education at teacher education level in Indian context.

7.11 Research questions

1. What is the level of understanding about constructivistic approach among pre-service primary student teachers?
2. What is the level of understanding about Environmental Education among pre-service primary student teachers?
3. How well the primary pre – service student teachers and their learners change their perspectives on Environmental Concepts using Constructivistic approach based classroom process?
4. Do the student teachers and school learners appreciate developing environmental knowledge through constructivistic approach?

7.12 Statement of the Problem
A study on Constructivistic Approach to Environmental Education among Primary Pre – Service student teachers

7.13 Objectives
1. To study student teachers changing perspectives (conception) about environmental concepts in the constructivistic classroom.
2. To study the application of constructivist teaching methods and strategies by student teachers while teaching environmental concepts in their classroom during internship programme.
3. To study students changing perspectives (conception) about environmental concepts in the constructivistic classroom.
4. To study the student teachers perception about constructivistic approach to Environmental Education.
5. To study the school learners perception about constructivistic approach to Environmental Education.

7.14 Explanation of the terms
7.14.1 Constructivistic Approach
In the literature on constructivism two terms viz., constructivistic and constructivist are frequently used interchangeably because of their unified meaning held by scholars (Sigrén, 2003; Simons, 2000; Terwindt, S.2000; Jonassen, D. H. 1992). In the present study also both the terms have been used at different places interchangeably. Constructivistic approach is a broader term which indicates that knowledge is constructed by the learner/individual by employing the means such as Problem Based Learning, Inquiry learning, concept mapping, cooperative and collaborative learning.

7.14.2 Environmental Education
Environmental Education is the education provided to the learners through different curricular content / concepts to equip them with better knowledge, understanding and developing action skills which will help to sustain better physical environment.
7.14.3 Changing perspective

Changing Perspective means the change that occurs in the student teachers and learners’ or students’ conceptual idea, viewpoint, and the way of thinking about any concept which he/she exhibits through their verbal or nonverbal expression.

Conceptual Change: Learners frequently enter learning situations with knowledge inconsistent with scientific views. This is termed as misconception / novice conception / tenacious ideas in different situations. The instruction is to enable students to construct scientifically accepted ideas while rejecting inaccurate constructs or larger cognitive structure. This process is called conceptual change.

7.14.4 Pre-service primary student teachers and Learners

The student teacher of first and second year primary teacher training institution, who are eligible to teach primary schools after completing the course. The school students are referred as learners.

7.15 Research Methods

In the present study the students/children were referred as learners. This research study is framed as a qualitative case study for several reasons. First, case study allowed me to examine closely student teachers’ development of ideas of constructivism and changing perspectives about environmental concepts within a specific context, namely problem based learning (PBL), Inquiry learning methods in a collaborative learning setup. In the same way, second, it allowed me to examine closely the extent the student teachers use/adopt constructivist teaching in their classroom as a teacher and changing their own learners’ perspectives about environmental concepts. Thirdly, it allowed me to use my own notes, plans, and reflections about the process as a participant observer at teacher education classroom and as an external observer at school classroom.

7.15.1 Location and Context of the Study

The present study was conducted at Tirupattur Teacher Training Institute, Tirupattur, Vellore District in Tamil Nadu. The name Tirupattur itself means a union of ten villages. Even though nearby towns like Vaniambadi, Ambur have many Tanneries and shoe making industries, Tirupattur don’t have any big industrial climate except one sugar-cane factory and sandal wood oil factory (presently closed) in nearby villages. The economic activities of the town are mainly agricultural.
The main crops around the villages are sugar cane, banana, cotton, cereals, pulses, rice, coconut trees, mango farms, sapota (Tropical fruit with a rough brownish skin and very sweet brownish pulp, generally called cheeku in Northern India). In recent years, villagers mainly cultivate cotton and those who have water facility go for sugar cane, banana and rice. The cultivation of pulses and cereals has gradually decreased. Due to agricultural crisis villagers are gradually losing interest in their farming activities and going in for some manual jobs outside the village. In recent years Beedi (a country made cigarette by tobacco leaves) and ‘agarbati’ (incense sticks) making has become common jobs in some villages.

In Tirupattur town, there are people belong to different religions viz., Hindu, Muslim, Christian and Jains. But the majority of the people belong to Hindu community. With regard to the composition of people in the surrounding villages of Tirupattur town, a peculiarity can be observed. While in some villages people belonging to a particular caste living completely segregating themselves from other caste groups, where as a mixed composition of people living together in some other villages. With regard to educational facilities Tirupattur has one Engineering college, two Arts and Science Colleges, four B.Ed. colleges and 10 Primary Teacher Training Institutions. Moreover, it is also an education-district (not a revenue district). The Tirupattur Teacher Training Institution is the first co-education teacher training institute in the town. It is located in Pachal village which is at the extreme end of North West part of the town.

7.15.2 Selection of Schools
Out of 21 schools allotted by District Education Office for internship programme (practice teaching) of Tirupattur Teacher Training Institute (TTTI), 4 elementary (Grade I to Grade V) and 3 middle schools (Grade I to Grade VIII) in the surroundings of Tirupattur have participated. This was done based on the willingness of school head masters. The schools were:

1. Panchayat Union Elementary School, Kathirampatti
2. Panchayat Union Elementary School, Madavalam
3. Panchayat Union Elementary School, Mel Achamangalam
4. Panchayat Union Elementary School, Salai Nagar (Indicated as no. 17 in the map
5. Panchayat Union Middle School, Kalaroor
6. Panchayat Union Middle School, Puthagaram
7. Panchayat Union Middle School, Kurumbar Colony

7.15.3 Selection of Student Teachers
For the objective one, all the 49 (19 male and 30 female) student teachers of first year and 50 (20 male and 30 female) student teachers of second year were purposively selected. For objective two, 11 student teachers of first year and 6 student teachers of second year were selected based on their willingness from the selected schools.

7.15.4 Selection of Themes
The selection of the themes for the research was done based on three aspects: (1) content analysis of text books, (2) concept maps of identified themes from content analysis (3) Focus group discussion with student teachers.
Examining all the three aspects (content analysis, concept maps and FGD) the following themes were identified by the researcher.
(a) House
(b) Health and Hygiene
(c) Soil
(d) Water
(e) Energy Resources
(f) Environmental Pollution

7.15.5 Data Collection Methods
The main data collecting strategies employed in this study were Focus Group Discussion, Participant observation, Semi and Unstructured interviews and Document analysis.

7.15.5.1 Participant observation
The data for the present study was collected through participant observation. The participant observation focuses on “…human interaction and meaning viewed from the insiders view point in everyday life situations and settings” (Jorgensen, 1989 cited in Ramkumar, 2003). In this study the participant observation was done in two phases.
In the first phase the participant observation was centered on teacher education classrooms. The focus was on observing how student teachers engage themselves in constructivist based classroom activities. In order to conduct the participant observation I took the role of a teacher educator. This allowed me to access and reach student teachers
in terms of “access to the world of everyday life from the stand point of a member or insider” (Jorgensen, 1989 cited in Ramkumar, 2003).

In the second phase the participant observation was centered on various school classrooms which were chosen for the present study. The researcher took the role of a practice teaching supervisor in the schools. This allowed me to access the learner and student point of view as an observer. I observed the way student teacher engaged learners in a constructivist based classroom activities. In these phases I observed two aspects (i) the perspective change (conceptual change) among the student teachers and the learners on environmental concepts. (ii) how well the student teacher adopted the constructivist principles in their classroom engagement in schools as a teacher.

Recording observations
In order to record observation Tape recorder, still photography and field notes were used. Tape recorder and still photography were used to record the action / event, when it really occurred. Tape recorder was used occasionally to report on the action of an event as it was happening in front of the observer so that narrative of an event is stored as it happens. Field notes were used to report on the day-to-day observation after the event occurred. Although this approach is well suited for the study it had its own problems. At early stages of my fieldwork, I faced some difficulty in writing down all my observation notes. This was because a number of activities took place simultaneously and in a short period of time. In the later stage at occasions I started recording my field experiences in audio tape to avoid time constraint in preparing for the next day’s work.

7.15.5.2 Interviews
The interviews with student teachers in teacher education classroom were more of conversation between teacher educator and the student teachers (group), student teacher – student teacher, student teacher group – student teacher group. However, the questions were not focused on individual student teacher but more on the group. Similar pattern of conversation happened between student teachers and their learners in schools. The casual conversations done after the class with student teachers provided lot of insight into various things such as their aspirations, opinion on the education system, teacher preparation programme, their social background etc.
Tape recorder was used to record the interview. In the event of non availability of audio cassette the interview were recorded with a note book or note pad.

7.15.5.3 Document Analysis
In this study document analysis consisted of the analysis of elementary level Environmental Studies (EVS) textbooks prescribed by Government of Tamil Nadu. This comprised of EVS text books of Grade I to Grade III, Environmental Science and Social Science text books of Grade IV and V, Environmental components from Science and Social Science text books of Grade VI to VIII. The content analysis was done to identify the general environmental themes which are dealt during the research work. Student teachers group work as well as learners’ group works written either in note books and sheets were analysed to identify their understanding on environmental concept / themes. In order to analyse the contents of student teachers, learners note books or sheets translation procedure was adopted. This gave me an insight into the way school learners view an activity or set of activities or theme.

7.15.6 Process of data collection
The entire study was carried out in 2 phases.

7.15.6.1 Phase –I (with student teachers)
In the beginning certain general environmental concepts were identified from the textbooks of environmental science (Grade I – IV), Science and Social Science (Grade V – VIII). The identified concepts were divided into two groups. Those concepts derived from Grade I to V were placed in group I, and those derived from Grade VI to VIII were placed in group II. This was done primarily keeping in mind the nature of examination to be taken up by the student teachers. After initial rapport building with student teachers, I started orienting about making concept map in both the first year and second year classes. I explained about how to make concept maps, different kinds of concept maps, and things to be taken care while making concept maps. During this time, I made a concept map on the black board about crops, based on student teachers ideas. After this I gave a concept in each period (allotted for my research) in the classroom and student teachers’ made the concept maps. This had taken one week time to complete. The first year student teachers made concept maps of health and hygiene, water and land. The
second year student teachers made concept maps on energy resources, environment and earth.

During this time I observed that, in afternoon of the day the second year students-teachers were going for physical education class, after the first period, regularly. The first year student teacher used to go after the second period. Here I found that there were good numbers of students chatting instead of playing games. So, with the permission of the Principal, I conducted focus group discussion in the afternoons. Through focus group discussion with student teachers I tried to know what do they think about the concept ‘environment’, and what are the issues they considered as related to environmental problem. There were quite a few issues the student teachers felt as very important environmental problem. One of them was traffic congestion in the town. But due to other reasons such as lack of time availability, subtle resistance from local faculty members, and student teachers’ tight schedule with other academic works, this issue could not be taking up during the current research work.

Based on the Focus Group Discussion and concept maps, the environmental problems were framed by me considering institutional factors. Then, I gave orientation about cooperative/collaborative learning by explaining about group formation, kind of leadership, material resources, role of the teacher and the assessment procedure. I also explained about Problem Based Learning, Inquiry learning and steps to be followed to solve a given problem. I have administered Multiple Intelligence (MI) test through the scores of MI each student teachers' strength in various intelligence areas was identified. I have tried to group those teachers who scored high in one particular intelligence test in one group. However other factors such as previous academic achievement, gender and their location were taken into consideration the group in a heterogeneous composition. I have tried to put the student teachers who have scored more in particular intelligence grouped together. Each class was divided into nine groups. Each group comprised of 5 student teachers; some group had six student teachers. Initially few student teachers wanted some changes in the formation of a group, because they wanted their close friends in their group. But I explained the reasons and convinced them. Here I faced some resistance from four teacher educators while making groups comprising both men and women. I was suggested to go for separate men and women groups. But the Principal stood by me and said that, “it is your research work, so you carry on the way you
Initially these teacher-educators were really angry, but gradually they cooperated with me.

After making the groups, I introduced the theme in the classroom by providing a paper to each group where the theme was written on it and asking a student teacher from any group to read it out loudly. If the student teachers wanted to listen to it once again, I asked another student teacher to read it again. Then the student teachers identified and listed down whatever the content they know related to the theme and what are the contents they should know to solve the problem and corresponding learning issues (concepts) in their individual groups. During this time, I moved around each group and observed their work and interacted whenever need arised. Once they listed down what they wanted to know (mostly in the form of questions) and learning issues (mentioning concepts), they started looking for the sources of information. Usually school textbooks, library books (public library), newspapers, the researcher and occasionally internet were their sources of information. Through discussions based on the collected information the group members made a report which communicated solution for the theme based problem. During these discussions if they proposed hypothesis or they found some more questions to be answered they were free to carry out some activities or test the hypothesis through collaborative problem solving by making them think critically or again look for solution through different sources of information, and this is where inquiry learning become handy. Also at times the group members sourced the information from the researcher. Through such activities they experienced the PBL and Inquiry method.

For each problem the groups took 1 to 3 week time to complete. During these group works I always moved around each group and audio recorded the interaction. As nine groups were working simultaneously, I decided to audio-record the interaction between me and the members of the particular group. Initially it was difficult for the researcher on how to go about it. Gradually I tried to see their group work by their writings or asking them on what they discussed so far. Whenever I have seen any alternative conception in their explanation, I probed them to know their perspective, and demanded further information to support their ideas. At times the group members themselves had contradictory views leading to searching for further information. Sometime they would find difficulty in locating information for which I suggested some sources or provided the information. Once all the groups completed their task, they
presented it to the whole class. At this point, most of the alternative conception/misconception they expressed earlier during their own group work was in progress was absent here. This was because the student teachers not only interacted in their own groups but they interacted with other group members after college hours. Occasionally some alternative conceptions expressed during the presentation were discussed in the whole class. The student teacher presentation of the first problem took 4 periods, which brought the resistance from the teacher educators. Also there was repetition of similar ideas expressed by different groups which brought less participation of students in post presentation discussions. To avoid this, the researcher used whole class discussion at the end of group work of each theme on alternative / novice / tenacious / misconceptions of the student teachers which they expressed during the group work.

The student teachers were asked to assess themselves as well as their peers about their participation and performance at the end of each theme. For this assessment Ann Lambros (2004) Individual student assessment group rubrics was used. The rubric is of two parts. The first part focus on participation in group work, one’s contribution, listening to others, asks and answering questions, stays on tasks, finding information, cooperating with other members, offering positive suggestions, exhibiting leadership and encouraging others. The second part focuses on generating effective learning issues, demonstrating hypothesis and testing, grasping of new concepts, applying new information for the group work, shows skill at teaching peers, demonstrating cooperation and consensus building, effective participation, identification and sharing appropriate resources, demonstrating growth of knowledge, exhibits functional decisive and focused qualities, exhibits leadership, encouraging others, assessing own strength and weakness appropriately. The rubric used four point scale where 4 indicate excellent, 3 indicates good, 2 indicates fair and 1 indicates poor. Student teacher group also submitted the learning logs (See in DVD) for each theme.

The student teachers’ work (student teacher group journal) I got from them for analysis. I wrote my experience regularly on a separate note book (field notes). When I do not get time to write field note I audio recorded the particular day experiences which was later used along with field notes.
7.15.6.2 Phase – 2 (Student teacher teaching at school)

After almost three month exposure (From 20th November to 15th February) of constructivist approach based methodologies in learning of content (along with learning about behavioristic methods) the student teachers went for a two month internship programme. In the first two week of internship, they were asked to observe the regular teachers’ classes. During this time, I visited all the selected schools and interacted with the Head Masters, teachers and student teachers. During those interactions I looked for the willingness of the student teachers in implementing constructivist based lessons in the school class lesson transaction, willingness of the school head masters in giving permission to student teachers to teach through constructivist approach, interest of the regular teachers of the school, and the availability of the classrooms and space (Because in some of the schools two grade a schools were sharing a classroom and due to summer season viz., February to April, the learners could not be taken outside the classroom). Based on these factors, I identified 7 schools for the study. Because of these factors some of the active participative student teachers of phase I who were very much interested in using constructivist approach in their classroom could not participate in phase II, and were not included.

A total of 28 student teachers were allotted to teach in these 7 schools during their practice teaching session. Among these 18 student teachers were from first year and 10 student teachers were from second year of their programme. Out of this, 11 student teachers from first year and 6 student teachers from second year showed interest and agreed to teach lessons through constructivist methods, over and above their with regular lessons. The remaining student teachers did not agree. This was because; whatever the lessons they taught through constructivist method were not to be counted as their ‘practice teaching’ lessons. These student teachers felt it was burdensome to teach through constructivist method as they were supposed to prepare two lesson plans along with teaching learning material (TLM) every day for the regular lessons.

During the internship of student teachers, I used to go to one or two schools in a day and observed their lesson transaction. I was contacting the student teachers through telephonic talk and (or) evening meetings and (or) going early to the schools. The student teachers used Problem Based Learning and Inquiry Approach in their learners. The learners from the school divided into cooperative groups for this research. The criteria
followed for making student teachers groups is used for making student groups. For framing the context based problem the student teachers went around the village and the school surroundings, and came out with certain environmental issues to be dealt in class. At times, student teachers discussed with the researcher for framing the problem. They adopted the problem based learning procedure which they experienced in their own teacher-education class. I observed their lesson transaction and audio recorded their interaction with their learners. During those times, I could see learners’ alternative conceptions and conceptual change through interaction with student teachers and their peers. The school learners used their textbook as a major source of information. Occasionally they referred to other sources. I got some books from Centre for Environmental Education, Bangalore for their reference. I collected learner work sheets for the analysis purpose. After six weeks of constructivist based teaching learning process, I interacted with school learners to know how they perceived the constructivist classroom. I audio recorded their views. I wrote my experience in field note. The student teachers found very difficult to write their experiences, because they were hard pressed with time, they had to prepare two lesson plans every day and Teaching Learning Materials for teaching. So virtually they had very little time to write their experiences. Instead, they shared their views with me during lunch time and during evening hours and these interactions have been recorded in my field notes.

Once they returned from internship, I again started interacting with student teachers on how they perceived teaching the environmental concepts through constructivist approach (with semi structured interview). I interacted with those who used constructivist approach in their lesson–transactions and those who did not. I also asked the student teachers to make concept maps on those concepts which were discussed in teacher education classroom. Once this process was over I thanked the student teachers for their cooperation.

7.16 Data Analysis
The data analysis was done during fieldwork and post field work. The data interpretation involved constructing the meaning on the student teachers, learners changing perspectives on environmental concepts through analysis of classroom interaction. The data analysis describes the units of analysis, procedure adopted for data analysis and the techniques adopted for establishing validity of qualitative data.
CHAPTER VII

7.16.1 Units of Data Analysis
The data was collected from various sources such as student teachers and learners group work, researcher’s field notes, audio tapes, still photographs, concept maps, rubrics for self and peer assessment and learning log on student teachers / learners working in groups or whole classroom situation. In order to assess the learning from these sources, it became apparent that individual is not the most useful unit of analysis. Thus, for the present study, the analysis of events and products that involved the negotiation between two or more participants in a group with different understanding of the situation became the necessary part of analysis (Vygotsky, Newman, Grifin& Cole cited in Ramkumar, 2003). The evidence presented is much more typical of all the participants than individuals. However, products of individual student teacher or learner were used in special circumstances to strengthen the evidence.

7.16.2 Procedure of Data Analysis
The data analysis was done in the following manner

1. Student teachers and learners participation in Constructivist classroom on environmental themes / concepts
2. Student teachers and learners perceptions about Constructivist Approach to Environmental Education

7.16.2.1 Student teachers and learners participation in Constructivist classroom on environmental themes / concepts
The data analysis consists of transcribing the recorded interviews. This was one of the most time consuming and frustrating activities during the post-field work. Each interview was clearly dated and labelled. Then I read the un-edited versions carefully, correcting the minor grammatical errors. During my second reading of un-edited versions of transcription I listened once again the tapes to identify the missing linkages. Then, I carefully selected the relevant information leaving the redundant information. The selected information from transcribed tapes, field notes along with the student teachers or learners group works (notebooks or sheets) were triangulated to view the occurrence of change in perspectives on environmental themes, recurring patterns of using the constructivist principles and methods by student teachers in their classroom engagement. These were analysed with respect to objectives one, two and three.
7.16.2.2 Student teachers and learners perceptions about Constructivist Approach to Environmental Education

Qualitative content analysis of audio transcription of semi-structured interviews of student teachers and learners was done to find out the perception about constructivistic approach in environmental education as part of achieving objective 5 of the study.

7.16.3 Establishing validity of Qualitative Data

In the present study Triangulation was used as a validity procedure, where researchers search for convergence among multiple and different sources of information to form themes or categories in a study (Creswell & Miller, 2000). In the triangulation procedure, researcher provides corroborating evidence collected through multiple methods such as observation, interviews and documents to locate major or minor themes (Ramkumar, 2003).

7.17 Findings of the study

The findings of the study have been expressed in the form of five assertions. The focus of these assertions is on the role of constructivist approaches on student teachers and learners learning.

 assertions One

Constructivist classrooms facilitated student teachers and learners to develop better understanding on environmental concepts.

 Assertion Two

Student teacher and learners proposed hypothesis based on certain concepts to explain the occurrence of events.

 Assertion Three

Student teachers and learners showed willingness to change ideas in the light of evidence

 Assertion Four

Student teachers' belief on constructivist approach – a key factor to become a constructivist teacher

 Assertion Five

Organisation of learning resources is important for successful constructivist classrooms
7.18 Discussion of findings:

The intent of this thesis was to understand (i) the student teachers change in perspective on environmental concepts during constructivist classroom experience at teacher education classroom (ii) the extent to which student teachers engaged the school learners on environmental concepts through constructivist approach (iii) the learners change in perspective on environmental concepts during constructivist classroom experience and (iv) the student teacher and learners perception about constructivist approach to environmental education.

The findings of this study suggest that constructivist classroom experiences facilitated student teachers and learners to develop better understanding on environmental concepts. This was due to the student teacher and learners’ interaction with the peers, teacher and learning resources. Similar such findings were observed by earlier researches (Ross (2008), Liang (1999), Jimarez (2006), Trundle (2000), Zinicola (2003), Marshall (2010), Ramkumar (2003), Muller Dahlberg (1999) and Ibrahim (2002)). Cognitive change often results from interactions with other learners who may hold different understandings (von Glasersfeld, 1989). These social interactions may challenge our current views as well as allow us to test our current understandings to see how well they help us make sense of and function in our world (Savery & Duffy, 1995). Student teacher and learners proposed hypothesis on concepts and process related to environment. The student selects and transforms information, constructs hypotheses, and makes decisions, relying on a cognitive structure to do so. Conceptual change was visualised when showed a tendency of proposing hypothesis based on their day-to-day experiences and what they come to know from other sources (Ramkumar, 2003).

The finding of the present study shows student teachers and learners showed willingness to change ideas in the light of evidence brought out through interaction among peers and learner and teacher in school and student teacher and researcher in the teacher education classroom. Similar such findings were observed by Soanes (2007) and Ramkumar (2003). Ramkumar study indicates that students expressed autonomy in learning through interactions with teachers and fellow peers, proposed hypothesis based on certain concepts to explain the occurrence of events during the context of scientific investigation, and showed willingness to change ideas in the light of evidence.
Another finding of this study indicates that student teachers belief on constructivist approach – a key factor to become a constructivist teacher. Smith (2000) study also indicates that the participation in constructivist classroom does positively affect pre – service teachers’ attitude toward mathematics teaching and learning as well as beliefs about the classroom environment. Eick (2000) study revealed that, one of the major factor consistently influencing use of constructivist practices is personal history informing beliefs and practices. Similar findings observed in Akcay (2007), Ji (2003) and McCaughan (2010).

However, Savasci (2007) study findings revealed that teachers generally reported that they held constructivist teaching and learning beliefs. However, they had difficulty in incorporating their beliefs into classroom practice. Only one teacher could implement his beliefs related to constructivist teaching and learning into classroom practice; as such, his expressed beliefs were consistent with his observed classroom practice. Personal Relevance and Student Negotiation were the most frequently preferred constructivist components and Critical Voice was the most perceived constructivist component in science classrooms. Shared control was one of the least preferred and was the least frequently perceived and implemented constructivist component in science classrooms. Whole- class activities were frequently observed in all science classrooms. A similar finding was observed by Lew (2001).

The other finding of the present study is that organisation of learning resources is important for successful constructivist classrooms. Hierlmeier (1999) study indicate that teachers made adjustments to their pedagogical thinking focusing more on several constructivist principles: personal relevance and learning styles, student initiative, daily discrepancy resolution, and appreciation for primary sources. McGlynn (2002) study revealed that firstly, most faculty – educators teach as they were taught, developing constructivist pedagogy requires a process of activity reflection, and dialogue for authentic change to occur. Secondly, planned change is successful when outcomes are identified, and conditions and resources are in place, which support the phases of the change. Gejda (2006) study indicated that participants reported practicing the 5Es (engage, explore, explain, elaborate, and evaluate) in inquiry – based instruction in their secondary science classrooms. Time, resources, the need to cover material for mandatory assessments, the science topics of concepts being taught, and professional development
on inquiry–based instruction were reported to be important considerations in participants’ decisions to practice inquiry–based instruction in their science classrooms.

7.19 Conclusion
The findings of the present study indicate that through constructivist-based classroom experience student teachers and learners understand the environmental concepts better. Their interaction with the various sources (peers, teachers, textbooks, newspapers, journals, TV, internet, libraries) in different point of time helped them to widen their understanding of environmental related concepts. It was observed that the social interaction with the group members and others play a key role in individual’s understanding of various concepts. This Vygotskian view that reinforces the idea in student to resort to the process of interaction in order to understand how others process the ideas rather than trying to comprehend the content/concept is an isolated manner. In this regard it is necessary to expose student teachers to constructivist classroom experiences in the teacher education programme itself. The constructivist based teacher education programme has to constantly deal with questions of practice as well as theory, linking teacher preparation programme closely with the school practices. This way the student teachers acquire a deep interest in theory and become reflective and critical practitioners.

7.20 Suggestions for the Further Research
The scope for further research can be seen in terms of understanding

- Impact of teacher beliefs of constructivist approach on their classroom practice
- Studies on student teachers and learners changing perspectives of various disciplinary concepts
- Information and Communication Technology enabled constructivist classrooms on student teachers and learners learning