Chapter Five

Major Findings and Discussion

5.1 Introduction

This chapter presents the heart of the research i.e. the major findings and discussion wherein the researcher has presented the findings and has discussed the findings in the light of earlier researches related to teaching of science integrated with life skill education.

5.2 Major Findings

- The first objective of the research being development of LSEP Programme, the researcher developed various group and individual activities, indoor as well as outdoor activities to teach science at secondary level. The designed activities provided testimony to the fact that it is possible to provide learning experiences based on characteristics and needs of adolescents and science process skills and principles of experiential learning. The Life Skill Education Programme was effective for development of life skills like critical thinking, creative thinking, problem solving and decision making through teaching of science.
- The developed Life Skill Education programme was implemented on a group of sixty students as per the decided time duration and periods specified from 15-07-2012 to 20-03-2013. The total time required for the implementation was 2,100 minutes (thirty five hours) in the classroom transactions i.e. twenty eight working days over a span of nine months which does not include the field work and the preparation time taken by the students for activities such as Health Survey in Sayaji Baug, Verification of Gravity exerted on objects of different masses and internet surfing, data collection at home by students for investigation of Electrical energy consumed per family. It neither includes instruction time for LSEP activities and discussion time utilized by investigator for noting indicators of life skills in observation diary.
- The developed Life Skill Education Programme was found to be effective in terms of enhancement of four life skills, details of which are presented below:
  - It was found that there was significant difference in the mean scores of indicators of creative thinking skill, decision making skill and problem solving skill of the students in pre test and post test with respect to the treatment given through LSEP

to Experimental Group hence the treatment given enhanced the status of these life skills.

- It was found that there was no significant difference in the mean scores of indicators of Critical Thinking Skills of the students in pre test and post test with respect to the treatment through LSEP to Experimental Group hence the treatment given made no effect on the status of critical thinking skill.
- It was found that there was significant difference between the gain scores of the Critical Thinking, Creative Thinking, Decision Making and Problem solving Skills of students of the experimental group to that of control group and hence effectiveness of LSEP was found more on the life skills of students of Experimental Group who were taught science with Life Skill Education programme than the students of Control Group who were not taught science with Life Skill education Programme, $U = 1.000$, $p = 0.043$
- It was found that there was significant difference between the mean post test scores of Critical thinking, Creative Thinking, Decision Making and Problem solving Skills of the students between experimental group and control group and hence effectiveness of LSEP is more on students' critical thinking skill, creative thinking skill, decision making skill and problem solving skill of Experimental Group who were taught science with Life Skill Education programme than the students of Control Group who were not taught science with Life Skill education Programme, $U = 945$, $U = 1077.5$, $U = 430.5$, $U = 714.5$ respectively and $p = 0.01$.
- Observed indicators of life skills in students, their feedback and ranking about each of the activity and their opinion after the implementation of programme.
  - Activity one: Drama: (Distance – Displacement) While watching drama investigator could observe indicators of life skills under study as C.T. – Ten, Cr. T. – Twenty Four, D.M. – Thirty three, P. S. – eighteen. This activity was ranked eighth by the students. Writing a paper pencil test does not give chance to students to mingle with each other in peer group, discuss scientific concepts with classmates and present it in the form of drama before the whole class that satisfies their need to seek appreciation from peer group.

- Activity Two: Drama (Acceleration – Retardation): During the presentations investigator could observe indicators of life skills as, C.T. – twenty three, Cr. T. – thirty Four, D.M. – forty, P. S. – twenty three. Students ranked this activity too as eighth. As each team performed the drama, number of questions related to theory of motion increased enthusiasm of the class to learn, unlearn and relearn.
- Activity Three: Investigation: Health Museum in Sayaji Baug based on topic 'Why do we fall ill?' Indicators noted during this activity were C.T. – thirty five, Cr. T. – thirty nine, D.M. – thirty three, P. S. – twenty five. Students ranked this activity as fourth. Students who didn't utter a single word in the first activity had many questions to ask and answers to give. This shows development in confidence and life skills in students.
- Activity Four: Health Survey on Common Cold among visitors of Sayaji Baug: Participant observation could come out with number of indicators of life skill as, C.T. – thirty six, Cr. T. – thirty, D.M. – forty five, P. S. – thirty two. Students ranked this activity too as fourth. Students made comprehensive report of data collected by each team and had conclusions showing relation between occupation, life style and the common cold.
- Activity Five: Make a toy: Catch the fly: Each team did this activity and exhibited critical thinking by asking questions like why, how, when and showed creativity in making the toy. The students used indicators of decision making skill in deciding the size of straw, angle between the straw, amount of force to be exerted and came up with different solutions to the problems occurred. Investigator counted the indicators of life skill during the LSEP as C.T. – thirty five, Cr. T. – forty one, D.M. – forty nine, P. S. – thirty three. Students ranked this activity as third.
- Activity Six: Make your own toy boat: This activity was ranked third by students. Indicators of life skills noted during this activity were C.T. – twenty eight, Cr. T. – fifty, D.M. – forty seven, P. S. – forty. Investigator could see the students using indicators of creative thinking, decision making and problem solving skills prominently. Presentations followed by probing helped

the students to understand Newton's laws of motion and could relate that elsewhere in the real world and they could identify situations in real life where laws of motion are seen to be used.

- Activity Seven: Colloids around you PPT / enactment of Advertisement: As observed by the investigator indicators of life skills noted were C.T. – forty two, Cr. T. – forty eight, D.M. – forty two, P. S. – forty three. Students ranked this activity as tenth. Thinking critically on the advertisements they see on television and comparing the information shown on T. V. with information in science textbook they could relate chemistry with real life. Few students could recognise the falsity shown in advertisements. They could point out the difference in reality of chemicals used in cosmetic products and claim the commercials make. Groups of girls who enacted showed the difference indicating use of critical thinking.
- Activity Eight: Seminar with 3-D model of the fundamental unit of life, Cell: As noted during presentations, the indicators of life skills were C.T. – fifty one, Cr. T. – fifty nine, D.M. – fifty nine, P. S. – fifty four. This activity was ranked Twelfth by students. While making the model they got opportunity to think critically on the components of cell, think of many alternatives to make it, foresee the consequences of taking any decision, and think of innovative idea to show parts of living cell. Some teams preferred making PPT for showing difference between plant cell and animal cell. "Use of technology is easy for us and PPT can tell many points at a time" was their comment. "Earlier in primary class we were never given such tasks for formative assessment, we love this" they said. This shows that activities of LSEP are liked by students and their thinking was getting sharpened during implementation of LSEP, simultaneously taking their minds down the tour of scientific concepts.
- Activity Nine: Does gravity exert same force on stones of different masses? Indicators of life skill for this activity were noted as C.T. – forty five, Cr. T. – sixty one, D.M. – fifty eight, P. S. – fifty five. Students ranked it as thirteenth. Initially teams made mistakes in calculation of value of 'g' experimentally,

when asked the reason for getting unequal values of g-theoretical, g-empirical; experimental errors were found, some had forgotten to convert units into standard units of length, time and acceleration. Thus discussions made them think critically on the experiment and could solve the problem after taking correct decisions. This indicates that the activity designed around science concepts gave enough scope to develop life skills.

- Activity Ten: Seminar with PPT on theme 'effect of pollution on plant tissues / animal tissues: Students placed this activity at fourteen. Concepts learnt in three lessons were woven well in the presentations. The teams could answer the questions asked by the audience on the topics from lessons named Plant tissues, Animal tissues and Our Natural Resources.
- Activity Eleven: Skit to show Rutherford's Experiment: In depth discussions on scientific concepts, cross questioning on structure of atom led to the development of many indicators of life skill. Indicators of life skill for this activity were noted as C.T. – fifty seven, Cr. T. – fifty five, D.M. – fifty, P. S. – fifty. Students ranked this activity as third.
- Activity Twelve: Investigation: Electric Bill: PPT presentation: The score of indicators noted by the investigator were, C.T. – forty five, Cr. T. – fifty nine, D.M. – fifty eight, P. S. – fifty five. Students ranked this activity as sixth. Students used different skills of computer operation creatively as well as indicators of life skills like critical thinking, decision making and problem solving skills for making PPT.
- Activity Thirteen: Make Green Niche: Practical activity of growing plants belonging to different divisions gave clear understanding of characteristics of plants that helped students to classify into different phyla. The indicators of life skill observed during presentations of the Green Niche by the investigator were C.T. – twenty four, Cr. T. – forty three, D.M. – forty nine, P. S. – forty five. This activity was placed at number seven.
- Activity Fourteen: Make Crystal Garden: Ionic Compound: Students made colourful ionic compounds using metallic impurities. All the team members could answer the questions asked by audience during presentation on

formation of ionic compound and covalent compounds. Students showed following indicators during this activity as C.T. – thirty four, Cr. T. – fifty five, D.M. – forty four, P. S. – forty three. This activity was ranked at eleven by the students.

- Activity Fifteen: 'Identify Me': Each team member enacted as an element belonging to their chosen 'GROUP' of the periodic table. Students showed immense pleasure in doing this activity and this lesson of Periodic Table which is not easy for the science teacher to teach in class IX was a joyful task with satisfaction looking to their achievement. Team members and the presenter answered their queries correctly. Indicators of thinking skill observed by the investigator during LSEP were, C.T. – forty nine, Cr. T. – fifty five, D.M. – sixty, P. S. – sixty one. Students gave second rank to this activity. All students except one loved this activity.
- Activity Sixteen: Mime: Identify the Phyla/class of animal: Students of class IX of the experimental group school did this activity in excellent manner. Each team out of nine teams chose any one phylum of animal and any one class in it. The teams depicted prominent characters of the phylum of animal chosen and showed it through mime. Indicators of each kind of life skills observed during the activity were C.T.–fifty seven, Cr. T.–sixty five, D.M.–fifty eight, P. S.–sixty two. Students ranked Mime at first rank. They enjoyed the mime thoroughly and could identify the animals exhibited. They were able to describe its classification after the activity.
- Activity Seventeen: Project Grandma: To imbibe the idea of recycle, reuse and reduce use of Natural Resources given in the last lesson of semester two, textbook of Science and Technology the activity named Project Grandma was assigned to the students. The students prepared questionnaire before going for interview, noted the observations, prepared a report and presented it before the class. Indicators noted by the investigator were C.T. – fifty five, Cr. T. – fifty eight, D.M. – fifty five, P. S. – fifty six. Students ranked this as ninth.
- Project grandpa was assigned with the objective to make students aware about herbs and food used by grandparents in earlier joint families for welfare of the

family. Students interviewed ten grand fathers and collected then analysed the data on home remedies through food grains and plant products used in Indian homes. Students ranked this activity as fifth. Indicators of life skills developed through this activity were C.T. – fifty seven, Cr. T. – sixty three, D.M. – fifty five, P. S – sixty three.

- Students were given a chance to use science process skills like measurement, observation, defining a scientific problem, experimentation, verification of results, arriving at a conclusion and writing scientific report. Though Life Skill Education Programme did not aim at developing science process skills, activities based on science content paved a way to development of science process skills too.
- Apart from thinking skills other life skills and values were seen getting developed in students. Other life skills like communication skill, coping with others, having empathy for others, coping with stress and other interpersonal skills were seen getting developed. Investigator could see value inculcation in them from change in their behaviour. Team spirit, respect for elders, value of time, value of money, value of unity were some prominently noted values in adolescents of class IX.
- Principal of experimental group school opined that the students of class IX actively participated in activity based LSEP to acquire the knowledge and skills with happiness and desire to learn more. According to the principal the effect of LSEP lasted even during next academic year on the students under treatment. Other teachers of experimental group school opined that students of class IX participated enthusiastically in the activities given by the researcher during implementation of LSEP. According to them Students had great fun in doing activities like visit to Sayaji Garden and mime to show classification of animals**.**

5.3 Discussion

Science is a body of knowledge having dual nature: as a product and the process. It is known as a process as it makes one define a problem and seek its solution by scientific method. Science can emerge as something alive, doable and therefore exciting only if it is

taught with that approach. While developing science process skills life skills can be developed (Position Paper, NCERT, 2006). If science is taught with student centric approach then science education will meet wider aims of education. During the review of related literature the investigator found that twenty two studies show development of life skills through specially designed life skill curriculum that are problem specific and found that the strategy of using separate curriculum for development of problem specific life skills is effective. Botvin et al (1980), Botvin, Baker et al (1984), Bharat and Kumar (2002), Prasad (2002), Zollinger et al (2003), Gamble (2006), Patel (2006), Ahmed, Azad, Galgali and Mehrotra in (2008), Nagpal and Srinivasan (2009) and have tried to develop problem specific i.e. content specific life skills for prevention of drug abuse or alcohol or prevention from AIDS through studies with experimental design. They examined the effect of Life Skill Education Programme on the adolescents and found it to be effective in improving mental health. Parvathy & Pillai (2014) conducted experimental study to improve 10 life skills given by WHO through LSE programme but not integrated with any subject. While Meghani (1999) developed critical thinking skill through teaching of Psychology to adolescents and found it effective. Hanumanthaiah in (2000) developed creative thinking skill through teaching of physics and Mark (2012) found LSEP based on physical education to be effective in developing creative thinking skill. From 1968 to 2013, thirty researches were conducted in the field of teaching of science by various techniques for school students and student teachers in India. Findings of researches conducted in the field of teaching of science by different strategies show that teaching science by innovative methods is superior in attaining objectives of teaching science compared to traditional methods. Findings of earlier researches conducted in the field of teaching of science in Gujarat show hardly any focus on development of life skills through teaching of science, so the researcher decided that it is desirable to teach science in secondary school by designing the activity based programme for the adolescents that gives scope to develop life skills which can make the adolescents ready to face challenges in daily life while achieving the objectives of teaching science. The developed Life Skill Education programme was implemented on a group of sixty students as per the decided time duration and periods specified in table_4.1 from 15-07-2012 to 20-03-2013. Life Skill Education Programme developed by the researcher has helped to

develop life skills in adolescents of class IX through teaching of science. It was found to be effective in terms of,

- The difference between the mean scores of indicators of Creative Thinking, Decision Making and Problem solving Skills of the students in pretest and post test with respect to the treatment given through LSEP to Experimental Group

  No significant difference was found between the mean scores of indicators of critical thinking skill. The investigator had coined the indicators of critical thinking skill as $\mathbf{CT_1}$ = Identify component of information, $\mathbf{CT_2}$ = Classify components, $\mathbf{CT_3}$ = Challenge assumptions, $\mathbf{CT_4}$ = Evaluate accuracy of information, $\mathbf{CT_5}$ = Arrange components to arrive at conclusion. Total score of each of these indicators counted after LSEP was, $\mathbf{CT_1}$ = 218, $\mathbf{CT_2}$ = 208, $\mathbf{CT_3}$ = 104, $\mathbf{CT_4}$ = 95, $\mathbf{CT_5}$ = 125. This data implies that students need more practice in activities that ask the students to challenge assumptions behind the information and evaluate accuracy of information. This made the researcher to ponder over the implementation of LSEP and examine the nature of activities in LSEP. The researcher found two reasons for inadequacy in gaining significant post test score of critical thinking skill.

- First, the activities designed in LSEP are required to be redesigned for using indicators of critical thinking skill. More activities in which students were supposed to challenge the authenticity of the information, activities in which students needed to explore assumption behind the information were needed to be designed. e.g. debate on 'Plastic a boon or bane' or 'Use of Urea in fields' or make a critical analysis of advertisement shown on face wash in Television.
- Second, while implementing each activity more emphasis should have been given on questions like why? What purpose? i. e. audience should have been trained to probe with questions that challenge the authenticity of information and assumptions behind it.
- The difference between the gain scores of the Critical Thinking, Creative Thinking, Decision Making and Problem solving Skills of students of the experimental group to that of control group.

- The difference between the mean post test scores of Critical thinking, Creative Thinking, Decision Making and Problem solving Skills of the students between experimental group and control group.
- Students' feedback and ranking of each of the activity and their opinion after the implementation of programme.
- Even though significant difference was not found in the scores of critical thinking skill of Experimental group and Control group when tested with Wilcoxon Signed Rank Test, the mean score of students of Experimental group for Critical Thinking was found to be higher in post test 70.65 as compared to the mean score value of post test 61.25 of Control group which indicated that there was enhancement in critical thinking skill i.e. the Life Skill Education programme was found to be effective. Result of Mann Whitney test used for testing significant difference between post test scores of both the groups have shown significant difference between them leading to conclude that LSEP was successful in enhancing life skills in Experimental Group.
- The mean post test score of students of Experimental group for Creative Thinking was found to be higher in 66.6 as compared to the mean score value of post test 56.1 of Control group which indicated that there was enhancement in creative thinking skill of Experimental Group i.e. the LSEP programme was found to be effective to develop creative thinking skill.
- The mean of post test score of Experimental Group was found to be 82.6 compared to 66.9 score of post test of Control Group. This indicates that LSEP could help to develop Decision Making Skill in Experimental Group. In contrast to this mean post test score of Control group was 66.9 while pre test score of Decision Making Skill was 66.9 thus status of Decision Making skill of control group was found to be same during the academic year. LSEP left positive impact on the status of decision making skill of experimental group. There was no significant difference in pre test and post test scores of Control group.
- The mean of post test score of Experimental Group for Problem Solving was found to be 77.7 compared to score of 64 for post test of Control Group. This indicates that LSEP could help to develop Problem Solving Skill in Experimental Group. In contrast to this mean Pre test score of problem solving for Control group was 64.7

while post test score of Problem Solving Skill was 64.0 thus status of problem solving skill of control group was found to have reduced during the academic year. LSEP left positive impact on the status of problem solving skill of experimental group.

- In very first activity of science drama student exhibited only eighty five indicators of life skill. Later score of indicator of life skills show enhancement. 242 indicators of life skills were observed for Mime in which classification of animals was learnt. This shows that Science activities designed to develop life skill were found to be effective in developing life skills.
- Drama to show difference between distance and displacement i.e. very first activity of LSEP was found to be difficult for fifty five students out of sixty, while five students found it easy but no one found it very easy. Later same type of activity related to performing art was found easy by many. Number of students who categorised skit as easy were thirty four, forty students found role play easy, thirty six students called mime as easy.
- Activities like seminar where the students were asked to present theme through PPT; involving use of computer technology were liked by many as they liked surfing internet. These activities were easy for them.
- Principal of experimental group opined that students of class IX actively participated in activity based LSEP to acquire the knowledge and skills with happiness and desire to learn more. According to the principal the effect of LSEP lasted even during next academic year i.e. in class IX on the students under treatment. Other teachers of experimental group school opined that students of class IX participated enthusiastically in the activities given by the researcher during implementation of LSEP.

5.4 Conclusion

On the basis of observations of this experimental study and its interpretations it can be concluded that Life Skills can be developed in class IX students while teaching science by the subject teacher in the natural classroom setting through Life Skill Education Programme. Integration of life skill based education programme with any curricular subject for teaching the syllabus given by school's respective board can be used for developing life skills in the class IX students and make learning a happy endeavour. The

ultimate aim of education as stated by scholars is to attain self realization that leads to guilt free, misery free, contended life. According to the investigator, teacher's role at any stage should be done in such a manner which will shape students' young minds with ability to take decision while thinking critically on the situation to be faced. It is essential to know creative abilities one has, availability of resources and address the problem with one's own limitations. The teacher can induce this in students only if enough experiences to sharpen life skills are provided to the students while teaching the curricular subjects. With this notion, the investigator has attempted to develop life skills. Life skills are the skills that help us to deal with challenges in life effectively and attain happiness by developing objectivity. Life skills are those skills that are necessary for full participation in everyday living. They help us to live life with grace, positive mind and gratitude. There is no perfect decision, it is alright to fail but trying for the best in given situation needs to be imbibed by students in adolescence.