CHAPTER III

METHODOLOGY

3.0.0 INTRODUCTION

The main aim of methodology is to describe and analyze methods, throwing lights on their limitations and resources, classifying their suppositions and consequences, relating their potentials to the twilight zone at the frontiers of knowledge. The present chapter describes in detail, the design of the study, nature and selection of sample and a brief description of the tools used in the investigation. It also gives a brief description of procedure adopted for the collection of data, its scoring and classification and finally the statistical treatment of the data for testing the hypothesis that were formulated.

3.1.0 RESEARCH DESIGN

The design one chooses is very much important to the validity of any conclusions that might be drawn from the research. Research design entails a logical and systematic plan prepared for guiding the entire research study. The present study was an experimental research. Quasi-experimental research design was used for the present study as the investigator was limited to randomly assign subjects to the treatment and control groups. Moreover, quasi-experimental designs that study the effect of treatment on single subject have been proven useful in behavioral sciences research. In the present study, a controlled group Pre-test, Post-test, non-equivalent group design was followed. The design of the present study is diagrammatically depicted as follow.

O1 X O2

O3 C O4

Where, O1 and O3 are Pre-Tests

O2 and O4 are Post-Tests

X= Experimental Group

C= Control Group

Following this design, two groups were selected with the help of convenient sampling as experimental group and control group. Pre-test was conducted to ascertain the level of understanding of students in science for both of the groups. Further, on the basis of the scores of pretests both the experimental and control groups were made equivalent. The experimentation was done with experimental group and the control group was taught science

in a traditional manner. At the end of the experimentation, post tests were conducted on both the groups.

3.2.0 POPULATION OF THE STUDY

In the present study, population consists of all the students studying in standard IX in English medium schools affiliated to Central Board of Secondary Education, New Delhi, during the academic year 2016-17 in the state of Gujarat. In the state of Gujarat, there were 316 CBSE affiliated schools during the academic year 2016-2017, constituting approximately 18960 standard IX students. Hence, the population of the present study constituted 18960 standard IX students.

3.3.0 SAMPLE OF THE STUDY

Considering the nature of the present study and following the stated research design, the sample for the present study was selected using convenient sampling. Two similar schools from Gujarat state i.e. Sri Sathya Sai Vidyaniketan, Navsari and Sri Swaminarayan International School, Eru, Navsari both affiliated to Central Board of Secondary Education, Delhi were selected as the sample school considering the convenience of the researcher to get access to the schools for the purpose of experimentation. Sri Sathya Sai Vidyaniketan, Navsari was considered as the experimental school and Sri Swaminarayan International School, Eru, Navsari was considered as control group as per the convenience of the researcher. There were 39 and 42 students in standard IX (Section B) of Sri Sathya Sai Vidyaniketan and Sri Swaminarayan International School respectively. On the basis of pre-test in science achievement, both the groups were made equivalent consisting of 37 students in both experimental and control groups. Hence, these 74 standard IX students constituted as the sample for the present study, having 37 students in both experimental and control group. The experimental group was taught science through Value Integrated Experiential learning for term-1 and during the same time, the control group was taught science through traditional method.

3.4.0 TOOLS FOR DATA COLLECTION

To achieve the objectives of the present study, the following tools were prepared by the researcher to collect the desired data for the present study which are as follows.

(i) Value conceptual Knowledge Test

(ii) Value Perception Scale

(iii) Achievement Test in Science

(iv) Reaction Scale

3.4.1.1 Value Conceptual Knowledge Test

The Value knowledge test was constructed by the researcher to achieve the objective 3 of the present study whose aim was to determine the conceptual knowledge of students about the selected values. The knowledge test comprised of 100 questions carting 1 mark each corresponding to the definition, meaning, and identification of correct situation, Identifying correct attributes and suggesting utilities of specific values. Five questions were there for each value, having 100 questions in all the 20 values viz. Learning to live together, Team work , Loyalty to duty , Tolerance, Flexibility, Curiosity, Environmental ethics, Compassion, Gratitude, Quest for knowledge, Discrimination, , Honesty, Spirit of inquiry, Co-operation, Equality, Simplicity, Determination, Common goal, Dignity of labour, and Discipline. The Value Knowledge Test is annexed in ***Appendix I.***

Marking Scheme: A marking scheme for the value knowledge test was developed by the researcher to check the conceptual knowledge of students uniformly**.** One mark was assigned for each components of each values i.e. Definition, meaning of value, identifying correct situation of that value, Identifying correct attributes of that value, and suggesting utility of that value. A total of 5 marks were assigned for each value and there were 20 values. Hence the total mark was 100 for the Value knowledge test.

3.4.1.2 Value Perception Scale

To measure the perception of students about the developed values in both experimental group and control group, a situation base value perception scale was prepared by the investigator considering the twenty selected values, such as, Learning to live together, Team work , Loyalty to duty , Tolerance, Flexibility, Curiosity, Environmental ethics, Compassion, Gratitude, Quest for knowledge, Discrimination, Honesty, Spirit of inquiry, Co-operation, Equality, Simplicity, Determination, Common goal, Dignity of labour, and Discipline. For each value, five life related situation based questions were with five alternative answers for each situation. All these five alternatives for each situation were considered as a scale of 1 to 5. The highest weightage is 5 for high positive perception, 4 is for positive perception, 3 for

neutrality in perception of the value, 2 for negative perception and the lowest being 1 for very negative perception of the given value.

In total, there were 100 close ended situation based questions for all the twenty values. The value perception scale is attached in ***Appendix II.***

Marking Scheme: A marking scheme for the Value Perception scale was developed by the researcher to check the perception of students about values uniformly. Every situation based question carried weightage of maximum 5 marks and minimum of 1 mark. In sum, there were 100 situation based questions in the value perception scale carrying a total mark of 500.

3.4.1.3 Achievement Test in Science

An achievement test in science was constructed by the researcher to measure the science achievement of students of both experimental and control group in the beginning and end of the term-1. The contents of science of standard IX from NCERT text book were selected for this purpose which consisted of seven and half chapters. A blue print was prepared for the question paper which contains 28 question of 1 mark each and 11 questions of 2 mark each covering all the 6 levels of cognitive domain (i.e. Knowledge, understanding, application, analysis, synthesis and evaluation). Items were divided uniformly among all the chapters. Time allotted for the question paper was one hour. Developed achievement test is attached in ***Appendix III.***

Marking Scheme: A marking scheme for the achievement test in Science was developed by the researcher to check the achievement of students in science. Section A carried very short answer type questions having 1 mark each and section B carried short answer type questions having 2 marks each. The total mark allotted for the achievement test was 50 marks.

3.4.1.4 Reaction Scale

Researcher developed a Likert type five point reaction scale to measure reaction of Students towards Value integrated Experiential Learning (*ViEL*). 25 statements were prepared related to different aspects of *ViEL* like presentation of the *ViEL*, Quality of materials in *ViEL*, Involvement of students in *ViEL*, interest in *ViEL*, Innovativeness and curious approach of *ViEL*, Skills development aspect of *ViEL, and the* Value development aspect of *ViEL*. All the statements were attached with a five point scale of reaction like, Strongly agree(SA) , Agree(A), Cannot Say(CNS), Disagree(DA) and Strongly Disagree(SDA) having the scale value ranging from 5 to 1 respectively. For all the twenty five items, the respondents were

asked to tick the appropriate one, depending upon his/her agreement with the item ranging from strongly agree to strongly disagree. The reaction scale is given in ***Appendix IV***.

3.4.2 Observation Note Cum Teacher's Diary

Researcher had used the observation note cum teachers' diary to gather information during the process of experiment. It comprises of minute details of behaviours and responses expressed by the students in experimental group. During the implementation phase, researcher observed the level of involvement, their reaction to different activities, like value games, making power point presentations on their topics, field observations etc. Along with these, the researcher observed misunderstandings and conflicts of students during the experimental process. The researcher also observed carefully about value practices in their day to day life, during peer group discussions, self-reflections, participation in all the activities that was planned and executed by the group, handling mistakes, conflict resolution, working on ideas, team work, managing in difficult situation during the learning process, effective communication in whole process, display of leadership patterns, time management, exhibition of IT skills, attitude towards work, creativity of learners etc. with the help of class teacher and science teachers. A sample Observation Note Cum Teacher's Diary is attached in ***Appendix V.***

3.4.3 Anecdotal record

Anecdotal record depicts each and every participant's personal details with regard to their participation, strengths, weaknesses, their achievements, individual suggestions for their improvements, initiatives they undertook during the process of the experiment etc. Anecdotal records of the students of experimental group were mentioned by the class teacher as per the guidance provided by the researcher. Live photograph of students with their emotions, expressions, moment of happiness, awe, wow moments etc. were also taken by the investigator. A sample anecdotal record is attached in ***Appendix VI***.

3.4.4 Validation of Tools and Pilot Testing

The content validity of the three major tools viz. Value Knowledge test, Value perception scale and achievement test paper were found out by the experts from the Department of Education, The M. S. University of Baroda, Vadodara, Department of Education, Veer Narmad South Gujarat University, Surat and Department of English, Navsari Agriculture University, Navsari and R. H. Patel English Medium B.Ed. College, Gandhinagar and Kadi

Srva Vishwavidyalay, Gandhinagar. Tools were given to subject experts and the test experts in the respective areas to find out the content validity of the respective tool. After getting Experts opinion necessary correction of tools were made by the researcher.

A pilot testing was carried out by the researcher for all the tools viz. Value Perception test, Value Knowledge test and achievement test in Science in Tapovan Sanskardham Vidyalaya, Dharagiri, Navsari (A CBSE affiliated School) during October 2015 in order to know the feasibility of the tools. Soon after the piloting, necessary modifications were done to finalize the tools for the data collection. A schematic view of tools with their objectives are given in table 3.1.

TABLE 3.1: SCHEMATIC VIEW OF TOOLS AND OBJECTIVES OF THE STUDY

Objectives	Tools used	Description of Tools
To study the effectiveness of the intervention programme on integrated experiential learning approach for value inculcation in teaching science in terms of value conceptual knowledge, value perception and value practice of the taken values along with the achievement in science.	Value Perception Scale	• Five situations per values • Total 100 situations for 20 values. • Total marks 500. • Time allotted: Two hours 40 minutes
	Value Conceptual Knowledge Test	Five questions per value Total 100 questions Total marks 100 Time allotted: Two hours
	Achievement Test in Science	28 question of 1 mark 11 question of 2 marks. Total marks 50 Time allotted: One hour
To study the reaction of students towards the intervention programme on Integrated Experiential Learning approach for value inculcation in teaching science.	Reaction Scale	Likert type five point scale with the degree of reactions like, Strongly Agree, Agree, Cannot Say, Disagree and Strongly Disagree. Time allotted: 40 minutes

3.5.0 PERSPECTIVE OF ViEL PEDAGOGY

Science teachers across the globe continuously strive to use varying learning strategies to enhance student learning. The contemporary educationists like Piaget & Vygotsky who formulated cognitive constructivism and social constructivism respectively are the pioneer in learning theories. Piaget talked about equilibration and content development, whereas Vygotsky emphasized on culture, social factors and role of language. Piaget was of the opinion that knowledge precedes language but Vygotsky said that language precedes thinking. For a long time the traditional approach in teaching Science comprising of *definition-example-exercise-practice* has made classroom more boring and dull. Therefore, interesting method of teaching science seems vital for which role of teacher is very important. There exists plethora of opportunity for teachers to make science class interesting by using **5E**(Engagement, Exploration, Explanation, Elaboration, and Evaluation) instructional model developed by Roger Bybee ,a part of innovators of BSCS (Biological Science Curriculum Study), **7E** Instructional Model suggested by Eisenkraft (2003) and multiple intelligence laden constructivist classroom proposed by Howard Gardner(1983**).** All the models advocate for a real life situation which will be the context through which the learners are engaged, exposing them using strategies of dialogue, role play, field tasks, manipulative activities, dramatization and many more support techniques.

The present ViEL scheme resemble with both 5E and & 7E model and somehow it can be 6E model. A schematic view of experiential learning used in the present study is illustrated below viz.

Silent sitting	⟺	Enable
Topic initiation	⟺	Engage
Radiant thinking	⟺	Explore
Mind Mapping and Web Charting	⟺	Elaborate
Group Activity	⟺	Explain
Presentation	⟺	Evaluate

Step-I: Silent Sitting is for inner harmony. Learning happens in a conducive atmosphere where students are free to think and less stressed about the marks and grades. To make the child less stressed silent sitting for one to two minutes is necessary for inner calmness which fosters creative faculty of the learner.

In this stage *teacher activity* is to maintain silence in the class, encourages inward look for all students.

Silent sitting has been considered an important strategy which helps in the habit of sitting quietly, strengthening the inner being or self, consolidating information received and retaining what is essential. Major advantage of silent sitting are , it helps in clear thinking, memory, health, concentration and assimilation, vigour and also helps to be in tune with oneself. Also, silent sitting helps in increasing ability to get along with others, improving self-confidence, reducing negative emotions and experiencing calmness and inspiration. It also stimulates creativity, increased memory, develops patience, and strengthens will power become quite and less restlessness. According to (NCERT, 2012) two minutes could be spared before beginning of the lesson in every subject, before starting the actual teaching. It serves as a warm-up exercise especially for younger children.

Figure 3.1: Silent sitting in progress

Student Activity: Follow the heart, Die mind (as in Fig.3.1).

This step *enables* the learner to undertake the task of exploring science in a very interesting way.

Step-II (Topic Initiation): The teacher gave a concept (one word) to the students, by writing it in the centre of the board. He established a context by giving an interesting/ stimulating activity by means of which the new concept can be explored. The teacher may say one key word or key concept of the chapter. Students were asked to think over it for 2-3 minutes. This phase was intended to motivate students to capture their interest in the topic which is supported by 'Active engagement involves inquiry, exploration, questioning, debates, application and reflection, leading to meaningful understanding, arriving at concept and creation of new ideas (NCERT, 2010)'.

Teacher Activity: Creates interest, raises question, and creates curiosity.

Students Activity: To ask question to self-such as what do I already know about this? Shows interest in the topic (Carin & Bass, 2000).

This step helps learners to *engage* themselves to venture into the main concept to be learnt that is given in the chapter.

Step-III **(**Radiant Thinking**):** Teacher asked all students to say words "related" to the topic. They wrote the words on the board and in their notebooks .There was no limit to number of words. In this way the interest of students was captured through some motivation by giving them feeling of considering them as valued key player in learning process, consideration of their own knowledge. Within this phase, the ideas of students were accumulated for clarification by each learner with the help of the teacher. The purpose of this phase was to determine the prior conceptions i. e What do you know about? (Suresh, 2012).

In this phase teacher worked as a guide, coach and facilitator, observes and listens to students as they spoke new words, provided time and motivated whole class for involvement, acted as a consultant for the class.

Students Activity: Thought freely but within the time frame, recorded ideas /words, suspended judgment (Carin & Bass, 2000). This step helped learners to *explore* new words related to the central theme that was given by the teacher by using prior knowledge.

Step-IV (Mind Mapping and web charting**):** The Teacher organized the class into groups of 5-7 children. Asked the groups to "categorize" the words in a logical way and prepare a master web-chart. Necessary explanation and meanings of scientific terms were provided to students by the teacher in order to help them to develop their own ideas. Here students had the opportunity to express what they knew about the unit topic or concept so that they can make connections between what they knew and the new ideas being introduced. A typical mind map looks like this as in figure 3.2 .

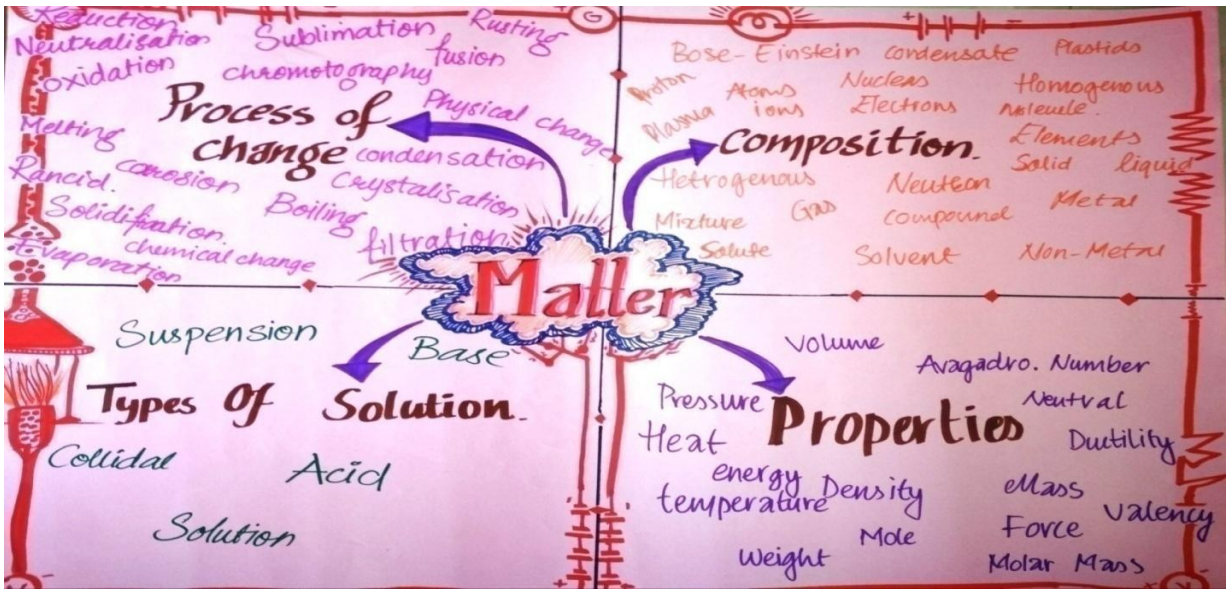

Figure 3.2: Master Web Chart

Teacher activity was to encourage students to apply or extend the concepts and skills in new situation, remind students of alternative explanations/examinations. To give clues like how does the theme affects you in your day to day lives? Why is it so important to study? What value would you learn from this chapter? What will be your take home points from the chapter?

Student Activity: Used previous knowledge to elicit new connections, analyses the interconnectedness between words, identified hidden values, defined the value in his own way, clarified about the values from the teacher, sometime checked for understanding between peers which is strongly supported by Carin & Bass (2000). This step helped students to ***elaborate*** new words related to the central theme that was given by the teacher by using various available materials like text book, lab manual, journals, magazines, science dictionary, encyclopedia etc.

Step –V (Group activity): Once the final web chart was decided, the teacher organized the class in groups, according to the number of categories. Students explored problems or phenomena through hands on activities, using their own language to discuss ideas. This exploration provided a common set of experiences which allowed the new ideas to make sense. The new ideas were applied to new situations and problems through student's discussion and analysis. This step helped each learner for self-construction of concept(s).Several group activities were organized in each chapter such as: role play, storytelling, group singing, poem writing, riddle making, making of cross word-puzzle, value games, concept map making, picture story writing etc. All these were integrated as part of scaffolding activity by teacher with the help of learners. A synoptic view of activities conducted is discussed in a lucid manner as follows.

Group activities provided opportunities for learning of many values concurrently, such as values of tolerance, cooperation love, peaceful co-existence, and respect for others. This was endorsed by NCERT (2012), i.e by working in groups, students learn the value of each other's sincere efforts, joy of doing one's best for the good of the whole group. Activities like: role plays, games, group discussions, group projects, etc. are part of group activities which could be used in teaching of various subjects. Unique feature of role plays is that it is meant for inculcating values where the emphasis was not on the acting capabilities but on the projection of ideas/values and analysis of the same .The analysis brought out why a person should or should not accept the value in question and act on all occasions upholding the same

which was in accordance with (NCERT, 2012) i.e 'The process of acting out helps in better understanding and reinforcing the importance of values'.

Story telling by students was used in this process as one of the activity according to the suitability of concept of science as stories have always been considered to be the best way to communicate important value-based message. Recent neurological research says mind has a preference for stories. As per (NCERT, 2012) knowledge is contextualized; it is situated and enmeshed in webs of meaning through a good story.

Similarly group singing was encouraged, as one of the activity as 'Group singing is important as values in the lyrics of the song remain in the consciousness for a long time. Also, group signifies co-operation, discipline, the unity towards a common purpose or goal, self-restraint and the spirit to accommodate. Selection of song is important and it could be chosen to reflect good thoughts and feelings of sacrifice, universal love, love of nature, motherland, respect for one's heritage and other's culture. Some of the subjects could be taught through the medium of songs at primary stage (NCERT, 2012)'. This is highly supported by the argument that learner's retain more information when doing purposeful experience as opposed to hearing or just reading about the experience by Edgar Dale through his famous Dales Cone of Experience (1946).

In this stage *teacher's activity is* to encourage students to explain concepts and definitions in their own words, Asks for justifications and clarification from students. Uses students' previous experience as the basis for explaining concepts (Carin & Bass**,** 2000).

Students Activity: Listens critically to one another's explanations, Questions one another's explanation, Uses recorded observations in explanation (Carin & Bass, 2000). This step helps students to ***explain*** one's own ideas to peer group, explains the correlation with values and get it approved from each one of the members so as to concretize learning about the given concept as part of the central theme.

Step-VI (Presentation): Each group performed a pre-presentation of their work, in front of the Class and finally in front of whole school. Children were asked to describe what they have done and discovered along with their value dimensions. This increased their deeper understanding about stated values and corresponding scientific skills. Students applied what

they have learnt to new situations. Students evaluated what they have learnt and learning was assessed. Ideas of students were challenged and compared with evidence from the scientific view point. Fig.3.3 indicates pre presentation of the whole group before final presentation in front of whole school.

Figure 3.3: Pre-presentation

Teacher's *activity: In* this stage the teacher assessed the students by using rubrics, designated portfolio. Teacher observed students as they applied new concepts and skills, assessed student's knowledge and value integration skills, and asked open ended questions such as: Why do you think..? What evidence do you have? How would you explain it…? How would you arrive at the conclusions…?

Students Activity: Replied open ended questions by using observations, and evidences, posed by whole school student and teacher community which is supported by the theory of Carin & Bass (2000). This step helped teacher to *evaluate* students learning about the concept(s), hidden values in each and every concepts and also students assess their own understanding.
In this way ViEL also developed skill, knowledge and awareness, and often started with specific narrow skills and then moved on to broad skills like team work, communication, time management, and leadership skills etc.

3.5.1 Teacher as a Co-creator in *ViEL*

In the process of ***ViEL***, teacher's role was very much critical in a sense that he was the ring master of the entire learning process, curator of the process and facilitator as well. Teacher provided an environment conducive to learning, where children felt secure, where there was absence of fear and which was governed by relationships of equality and equity. Teacher created various situations wherein students interacted with each other and with the teacher, to understand the concept(s), and then the teacher refined or revised those concepts by asking

questions, posing contradictions and engaging them in inquiries. Teacher engaged his students in discussion in a democratic set-up of the classroom to facilitate them to understand the words and concepts not understood yet. In this process every students felt that they are valued and their own knowledge about their surroundings are valuable as a resources of experiences to be analyzed and inquired into at school, they get motivated to learn and finally learning happens. During the whole process teacher minutely observed values like co-operation, determination to finish task on time, Curiosity to know from others, group discipline, team work, flexibility, loyalty to duty etc and ensured their proper reflection and articulation on part of each student. Also ***ViEL*** provided ample space for the children to find their voices, nurture their curiosity, to do things, to ask questions and to pursue investigations, sharing and integrating their experiences with subject of science which makes it more meaningful for their life.

This led to no student ever feeling tense or depressed about his or her performance in any chapter wise experiential learning. It was recognized and easily accepted that everyone could not be equally good in all areas. This *'anand'* (eternal happiness) comes from creating an environment of cooperation and harmony, full of natural beauty and filled with love. It is important to encourage the sense of enquiry and self-expression which every child is born with.

3.5.2 *ViEL* Pedagogy

In India Science is considered as a compulsory subject right from standard I till standard X which spans for ten years .It still unclear about the fundamental purpose of teaching science for ten years in schools. According to Joy (2009) the purpose of teaching science in schools is that it can inculcate in students certain values and attitudes – scientific temper, reasoning, problem solving, rationality for enlightened citizenship and making manpower for India's growth & development. Adding values and skills to science teaching is of paramount importance. Hence, value integrated experiential learning model is in discussion which is exemplified in fig.3.4.

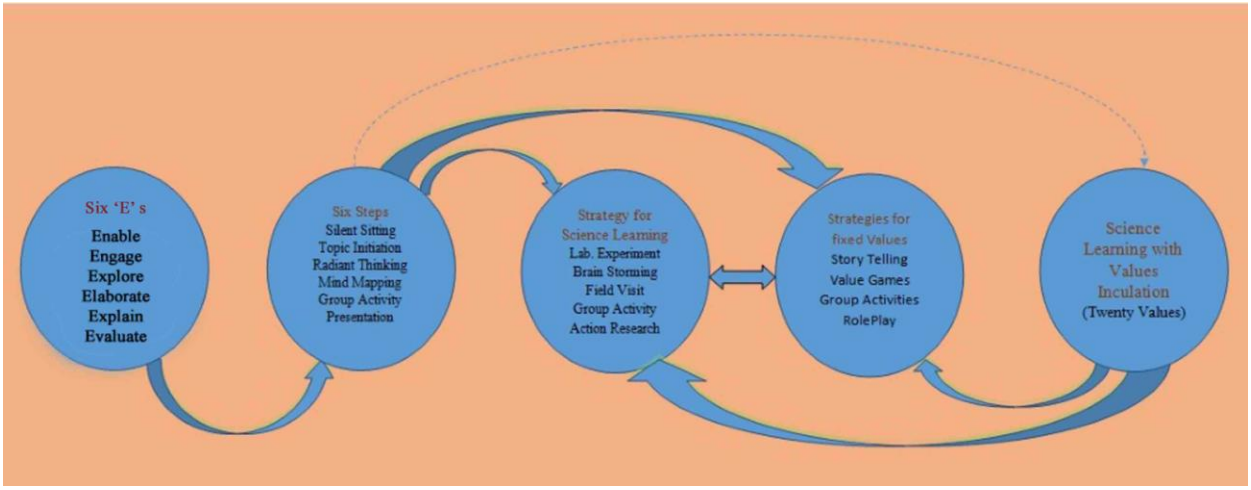

Figure 3.4: ViEL pedagogy

This ViEL approach does not have standardize methods of teaching. It enables each student to construct the meaning of the concept on their own in an optimal level which is opposite to teacher driven teaching i.e the teacher chooses just one style of teaching (direct instruction, not collaborative learning, inquiry learning and so on), the students may not assimilate the concepts to the optimal level. Students learn best not when someone tells them how to do something, but doing it themselves. This belief is explained in the ViEL model of instruction. If meaning is created from different sources and varied experiences including all sensory inputs under action then learning seems fruitful.

In ViEL, constructivist philosophy lays emphasis on learners' need to build their understanding of new ideas through self-experiences. Much has been described by stalwarts of educational thinkers like John Dewy, Jean Piaget, Eleanor Duckworth, George Hein etc. from time to time and ViEL conforms its alignment to previous theories. The ViEL pedagogy has its core form 5E model and tends to be like a 6E model with enable**,** engage, explore, elaborate, explain, and evaluate which lies in between 5E and 7E model. The first step of the ViEL pedagogy is Enable i.e through silent sitting the learner need to attain mental equilibrium which is very much needed for the science learning. In second phase the teacher establishes a context by giving an interesting/ stimulating activity by means of which the new concept can be explored. The teacher may say one key word or key concept of the chapter. Students are asked to think over it for 2-3 minutes. This phase is intended to motivate students to capture their interest in the topic i.e Engage. Few ice breakers or stimulus was given to learners to bring their focus on the concept. In third phase, teacher will ask all students to say words 'related'to the topic and they will write the words on the board and in

their notebooks. In this way the interest of students are captured through some motivation by giving them feeling of considering them as valued key player in learning process which is nothing but Explore. Here, science teaching strategies like group activities, storytelling, laboratory activity, brain storming activity and value inculcation strategies like Value games, role plays etc. are incorporated by students in consultation with teacher. In fourth phase, teacher divides the class into groups and asks them to "categorize" the words and prepare a Web-chart. Necessary explanation and meanings of scientific terms are provided to students by the teacher in order to help them to develop their own ideas i.e Elaborate. In fifth phase students have the opportunity to express what they know about the unit topic or concept so that they can make connections between what they know and the new ideas being introduced thereby explain the concept they understood. Finally they make presentation in groups which evaluates their learning. In this ViEL pedagogy both indoor and outdoor activities were interwoven so as to give learner a good chance of enhancing their content knowledge, presentation skills and understanding science.

3.6.0 DEVELOPMENT OF VALUE INTEGRATED EXPERIENTIAL LEARNING (ViEL) IN TEACHING SCIENCE.

To achieve the objective 1 of the present study i.e. to develop an intervention programme through value integrated experiential learning approach for teaching of science to standard IX students for the inculcation of values like : Learning to live together, Team work , Loyalty to duty , Tolerance, Flexibility, Curiosity, Environmental ethics, Compassion, Gratitude, Quest for knowledge, Discrimination, Honesty, Spirit of inquiry, Co-operation, Equality, Simplicity, Determination, Common goal, Dignity of labour, Discipline, the researcher developed Value Integrated Experiential Learning (ViEL) for teaching science to standard IX students. The main purpose of the intervention programme was to inculcate these values among students by teaching Science through experiential learning method. In the present study, the development of ViEL included four stages as follow, selection of Content, Identification of values, Preparation of lesson plans and planning for execution.

3.6.1 Selection of Content

Text book forms an integral part of any school curriculum as it contains the overall provision of the content for the learner for a given time period. Contents for developing Value Integrated Experiential Learning were selected from Science text Book of NCERT (2006), First Edition. The text book contained 15 chapters for both the terms. Seven and half chapters

meant for term 1 were taken for the development of ViEL. These chapters were, (1)Matter in our surroundings, (2) Is matter around us is pure?, (3) The fundamental units of life, (4) Tissues,(5) Motion, (6) Force & Laws of motion, (7) Improvements in food resources and (8) half of the chapter on Gravitation.

3.6.2 Identification of Values

Content analysis of the selected seven and half chapters of the standard-IX science text book meant for term 1 was done to identify the values present in those chapters and those can be taught to the students along with the teaching of science. The values those most frequently found in these chapters were identified and the total numbers of such values were 20. Those values were equality, co-operation, simplicity, dignity of labour, determination, honesty, common goal, curiosity, quest for knowledge, discrimination, discipline, environmental ethics, spirit of inquiry, gratitude, compassion, flexibility, tolerance, loyalty to duty , team work and learning to live together. These values were made integrated in the ViEL along with contents through lesson plans.

3.6.3 Development of Lesson Plan

Lesson plans were prepared on these selected contents following the constructivist approach. In the present study, modified 6E lesson plan approach was adopted including the components like, Enable, Engage, Explore, Elaborate, Explain and Evaluate. Similarly, experiential learning follows six steps activities like, (1) silent sitting, (2) topic initiation, (3) radiant thinking, (4) mind mapping and web charting, (5) group activity and (6)presentation. All these Six components of constructivist approach were aligned with the six steps of experiential learning activities to form the lesson plan for ViEL which is illustrated in fig. 3.5

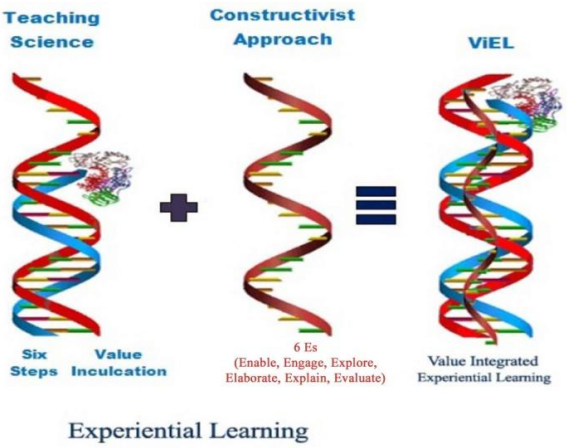

Figure 3.5: Integrated Experiential Learning Model

For the present study, the activities like, Value games, Role plays, Value Cross word puzzle making, Value songs, movie, Storytelling were used for the inculcation of the selected 20 values. Further, these activities for value development were integrated in the ViEL as per the demand of the content for value inculcation along with the 6E components of constructivist

approach and 6 steps of experiential learning. For each content, three to five lesson plans were prepared considering the 6Es of the constructivist approach, six steps of the experiential learning and the activities for value inculcation. Attempts were made by the researcher in preparing the lesson plans to teach science to standard IX students highlighting the selected values adding different strategies to develop those values among students. Sample of lesson plans are given in ***Appendix VII***.

3.6.4 Planning for Execution

After getting necessary permissions from the school authority, the researcher planned for the experimentation of ViEL spreading throughout the first term of the academic year 2016-17 (April-Sept.2016). A total number of working days available for the experimentation were 110 days including teaching - learning and evaluation. The ViEL implementation plan for Standard IX science is given in table 3.2.

Table 3.2 Planning for Value Integrated Experiential Learning

Month	Chapters	Contents of Chapters	Experiential Learning Activities	Values Covered
April	Ch.1.Matter in our surroundings	Physical nature, Characteristics of particles of matter, states of matter, Change of state	EL-1 : Matter	Common goal, discrimination, Curiosity,
July	Ch.2.Is matter around us is pure ?	Solution, mixture, suspension, colloidal solution, separation of solution & mixtures, elements, compounds,	EL:4 Purity of matter	Honesty, Simplicity, Tolerance, quest for knowledge,
April	Ch.5.The fundamental units of life	Composition of living organisms, cell, structural organisation of cell-cell membrane, cell wall, nucleus, cytoplasm etc., cell organelles (ER, plastids, golgi apparatus, lysosomes, mitochondria, vacuoles)	EL-2:cell	Team work, Cooperation, Discipline
July		Tissues, meristematic tissue,	EL-5	Loyal to duty,

	Ch.6.Tissues	permanent tissues, complex permanent tissues, animal tissues (Epithelialtissues, connective tissues, muscular tissues, nervous tissues)	Tissues	Learning to lives together environmental ethics,
June	Ch.8.Motion	Describing motion, motion in a straight line, uniform & non uniform motion, velocity, acceleration, graphical presentation of motion, equation of motion by graphical method, uniform circular motion.	EL-3 Motion	Flexibility,
August	Ch.9: Force & Laws of motion	Balanced & unbalanced force, First law of motion, Inertia & mass, Second law of motion, Mathematical formulation of second law, Third law of motion, Conservation of momentum	EL-6 Force	Discipline, Cooperation, Tolerance,
August	Ch.10: Gravitation	Gravitation, free fall, Weight, mass	EL-7 Gravity & gravitation	Discipline, spirit of enquiry,
August	Ch.15: Improvement in food resources	Improvement in crop yield, crop production & management, crop variety improvement, Animal husbandry, organic farming	EL-8 Crop	Equality, Dignity of labour, compassion

3.7.0 IMPLEMENTATION OF ViEL

The whole process of experiment to implement the ViEL was done in following three phases.

Phase I: Pre Testing

Pre-testing was conducted in both the experimental and the control groups during the month of April, 2016. The tools namely Value Knowledge test, Value Perception scale and achievement test in Science were administered to the students of both experimental group and control group.

The value perception scale was administered in both control group and experimental group in the first week of April 2016 in four phases spanned over 40 minutes each. Value knowledge test was administered soon after the value perception test in both of the experimental & control groups respectively in the same week. Similarly at last day of the week achievement test in Science was administered in both of the groups.

Phase II: Experimentation

The experimentation was done on the students of experimental group right from the second week of the April, 2016. They were taught science during the whole term-I (April – September) by the researcher during the academic year 2016-17 with the help of the developed ***ViEL.*** The ViEL pedagogic process were : reading science(topic initiation) writing science(radiant thinking), talking Science(mind mapping and web charting),doing science(group activity) and representing science(presentations) which is represented in the figure 3.6**.**

Total periods taken by the researcher including laboratory sessions and field visits were 102 of 40 minutes duration spanning over 17 weeks.

Figure 3.6: Experiential learning progression

Following were some of the glimpses of various activities implemented during the entire experiential learning sessions.

(1)**Visit to Dandi Forest House**: The Gujarat forest department managed a park and housed a small museum about flora and fauna of Navsari district. Students visited the museum on15th August 2016 as part of field visit and paid their respect to father of nation and witnessed the history of Indian freedom movement. In addition to this, they visited the museum where in the researcher explained about flora and fauna of Navsari district which is given in fig.3.7

Figure 3.7 Visit to Dandi

(2) **Showing of science blogs and important websites:** Open Educational resources are gaining importance in classroom discourses in India at a snail's pace. In order to expose learners about various digital resources available in science especially science websites and science blogs, sessions were organized by the researcher in lieu of it and every one witnessed the beauty of e-resources like videos, science blogs and important science websites like: www. nroer. gov.in, http:// teachers of india. org/en, http:// www. arvindguptatoys. com/toys.html etc. It is given in fig.3.8


Figure 3.8 Explanations of Blogs

(3)**Poster Exhibition for conservation of natural resources**: The plight of degradation of natural resources were highlighted by students, its impact on humans and on the earth as a whole was articulated by learners in a lucid way of poster exhibition(as in fig.3.9) as part of the requirement of chapter 5 (The fundamental Unit of life) and chapter 6 (Tissues).


Figure 3.9 Poster Exhibition

(4)Individual lab activities for contents : Activities like solubility of substances, filtration, Matter is made up of particles, Particles of matter are continuously moving, Conversion of Ice to water and water to vapour, factors affecting Evaporation (China dish and Test tube activity), Sublimation (Camphor Activity), Preparation of Colloidal solutions (Milk- Emulsion and Mud-Solution), Separating two miscible liquids by distillation (alcohol and water), Cells of onion peel (by using microscope), Growth of roots in onion bulb (Plant Tissues-Activity 6.1- Meristematic), Distance and Displacement (Activity 8.3), First law of motion-State of motion and state of rest (activity 9.1), Third law of motion (skate board activity-Action Reaction- Activity no.9.4), Centripetal force –activity 10.1 were conducted as part of ViEL sessions .It is given in fig.3.10.

Figure 3.10 Lab demonstration

(5)**Activity**: **Making life sketches of scientists:** Reading biography of scientists enthralls us about their achievements and hard work. Their contributions to the field of science cannot be ignored at any point of time. Therefore, to sensitize students about the life of eminent scientists, a sketch making activity was organized for students. They were asked to make life sketches of Isaac Newton, S. N. Bose, Charles Darwin, James Prescott Joule, Archimedes, Albert Einstein, Robert Brown, Robert Hook, A.V. Leeuwenhoek, and Galileo Galilee. Students were asked to make the life sketch which included time line of life of scientist, Field of contribution, known for etc. as part of their understanding. Sample life sketch of Scientists prepared by students is given in Fig.3.11.

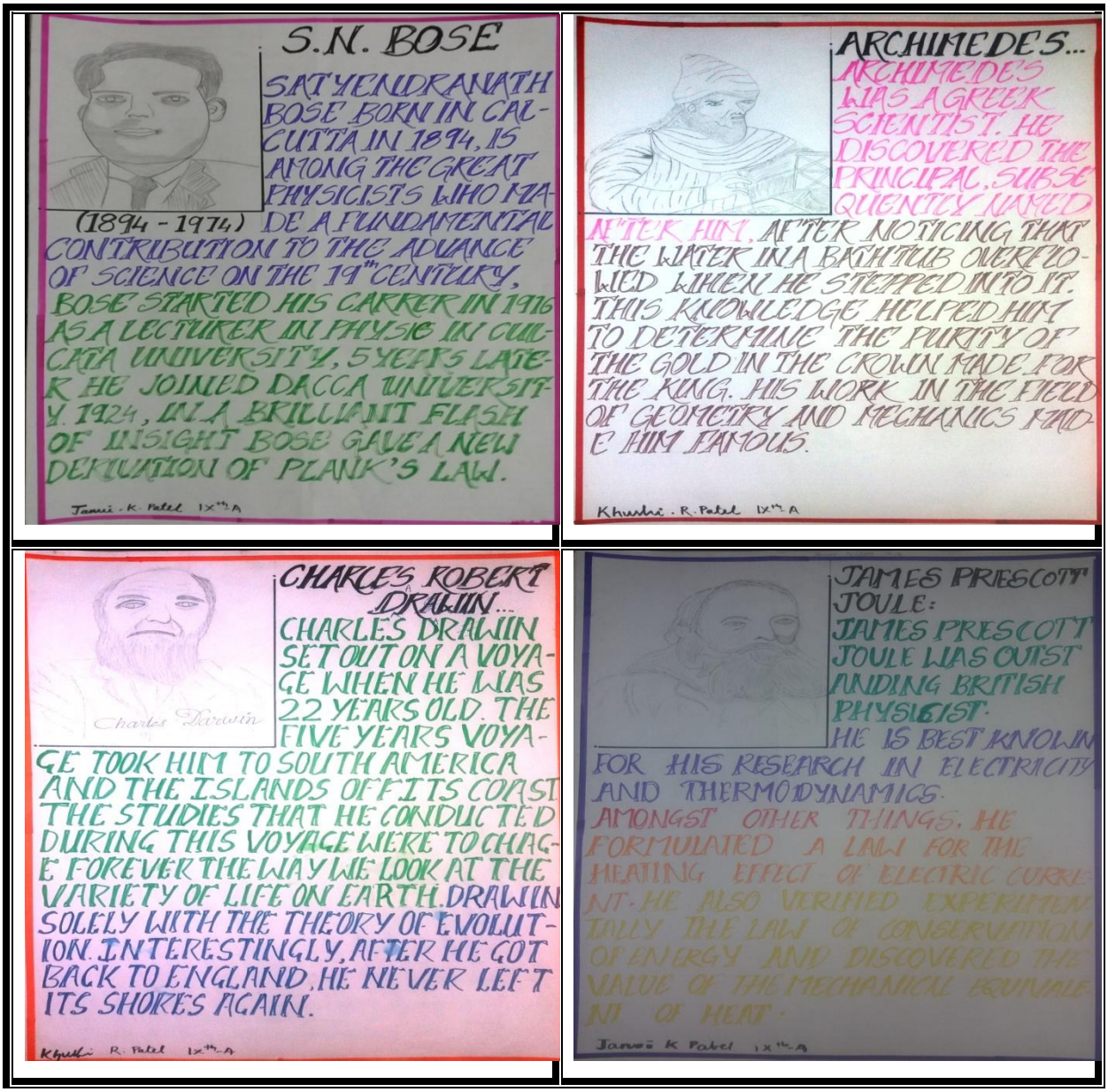

Figure 3.11: Life sketches of scientists

(6) Concept Map Making: Concept maps are visual representations of concepts and their interrelationships to make it easier for understanding by the learner. It also talks about central idea and its bifurcation into several small braches each representing sub concepts. After step III of ***ViEL***, students were given information about all central ideas like matter, cell, tissues, motion, gravitation, food, Force etc. Students prepared one concept map for each main idea and there were eight concept maps in total which was prepared by students in consultation with the researcher. A schematic view of concept maps is given in figure 3.12.

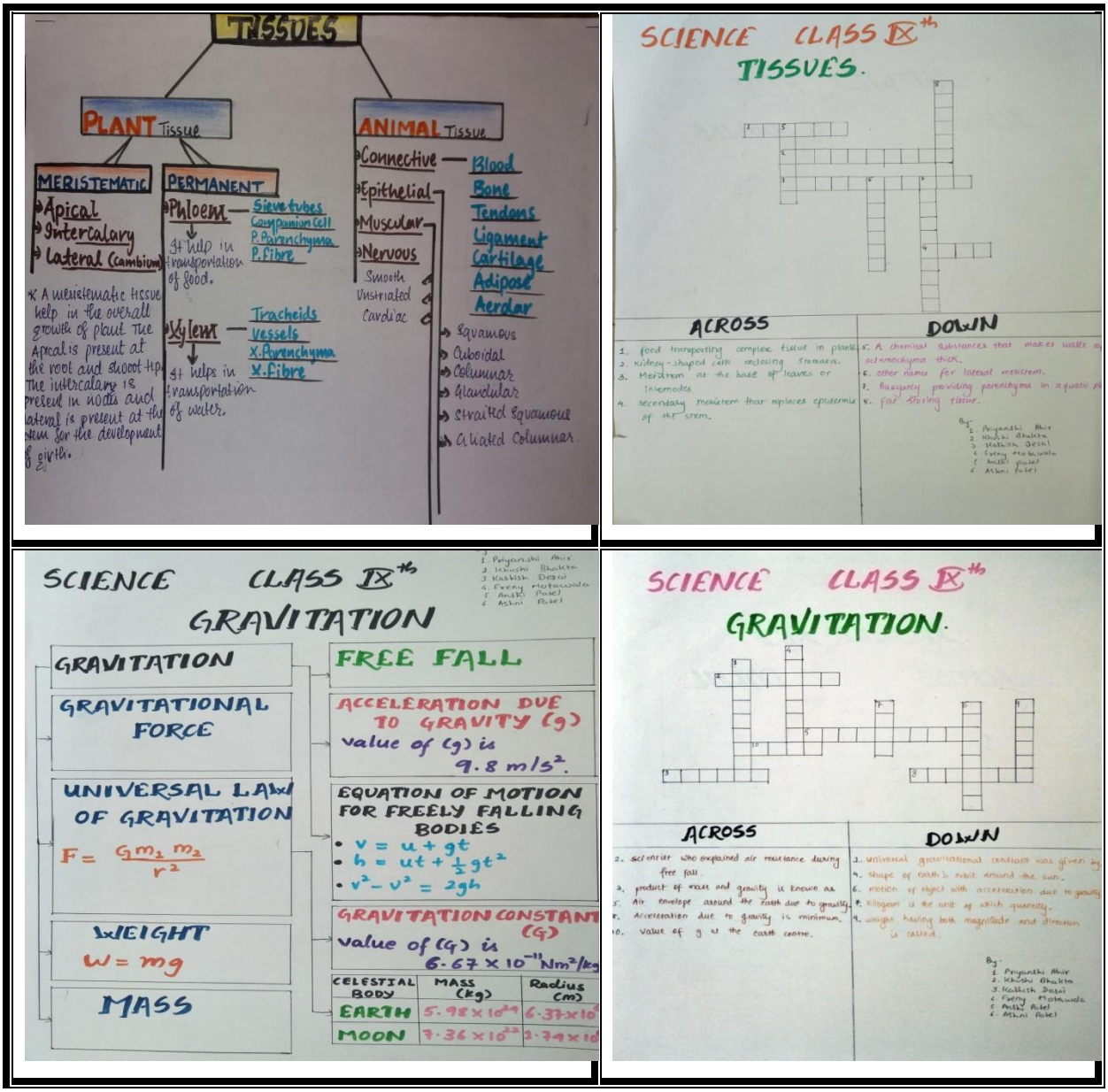

Figure 3.12: Concept maps prepared by students

(7) Making Key word Puzzle: It is a descriptor like magnetic compass that helps us to capture the essence of any concept or topics. Every chapter's contains several key words. By understanding these key words, it is easier for the learner to delve into the topic to acquire wholesome understanding about the concepts associated with these key words. In the ViEL pedagogy, key words are most notable tools in the hands of each learner to develop understanding about the science concepts. Therefore, the researcher assigned keyword puzzles to each and every group and they made it nicely which is depicted in fig. 3.13.

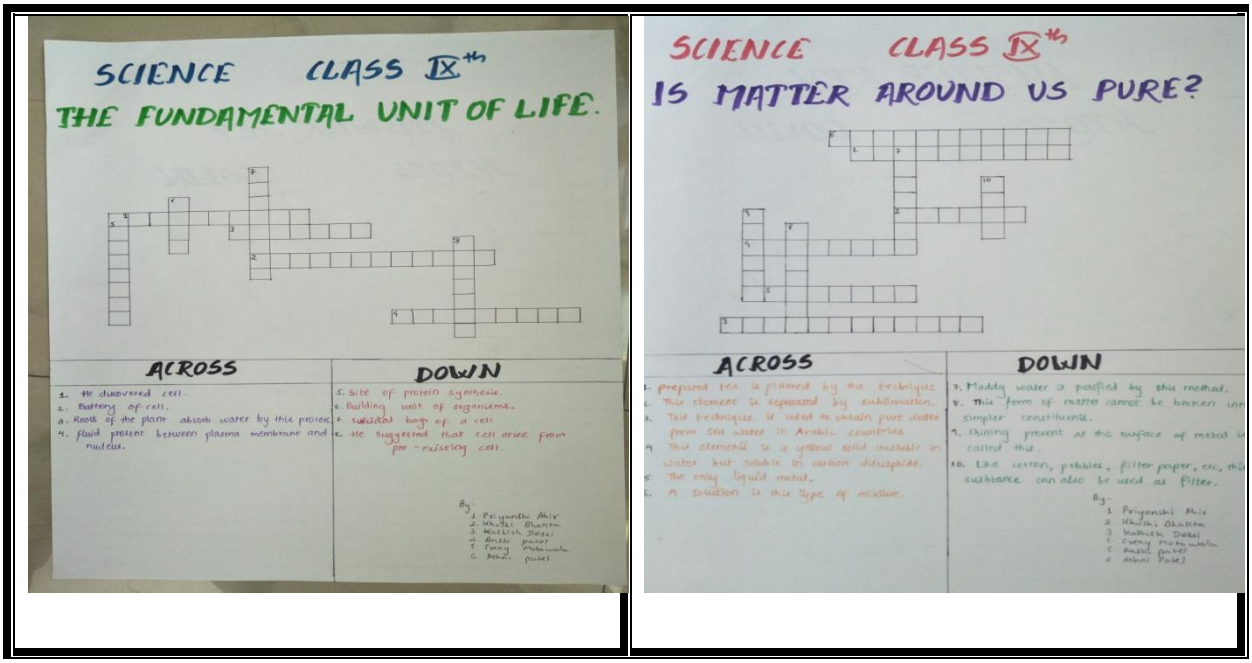

Figure 3.13: Key words Puzzle prepared by students

(8) **Scrap book activity:** A simple scrap book activity builds resilience in students to represent their understanding in a simple and meaningful way. The scrapbooking activity is a wonderful method of integrating many facets of graphic arts with fun and enjoyable way while educating them the values of resourcefulness, inspiration, perseverance and patience. Students were asked to prepare scrap book for twenty values that were discussed during entire term 1 and they surprised the researcher with wonderful scrap books which is illustrated in fig. 3.14.

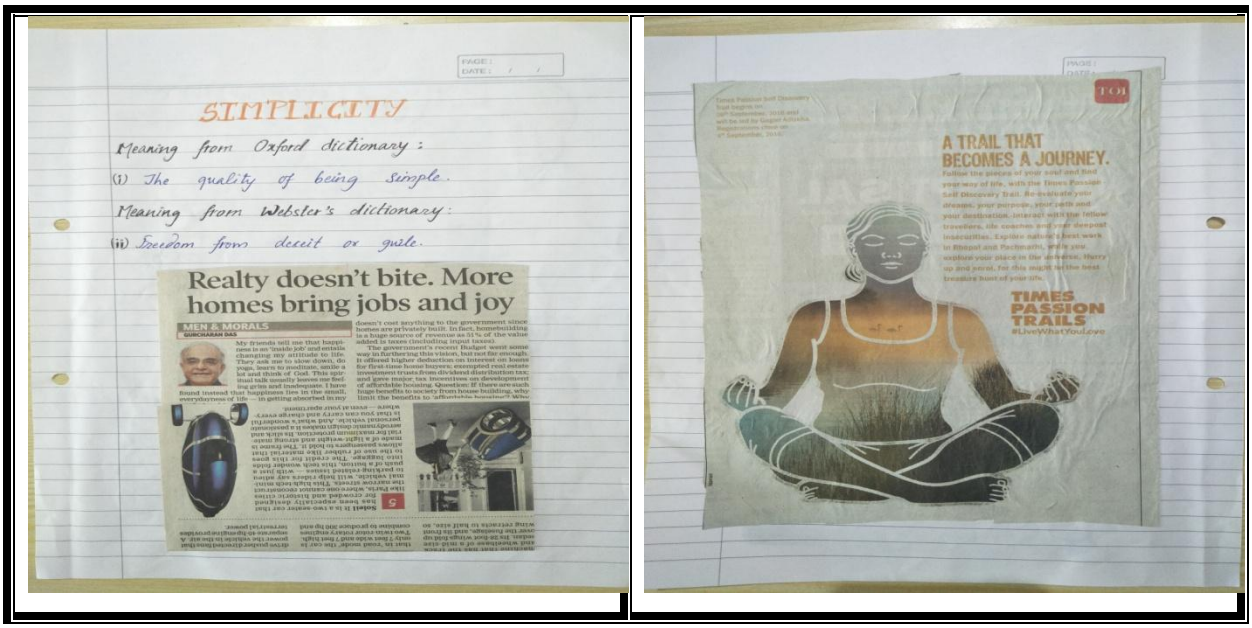

Figure 3.14: Scrap book activity on values

(9)Making of Keyword Dictionary

Keywords in the chapters are the navigation compass to venture into chapter for getting the details about it. These key words were collected by students during Exploration phase of experiential learning process and organized in a very systematic way so that one can refer it as *Key word dictionary* (fig.3.15) and it was prepared by students and kept in classroom library for ready reference.

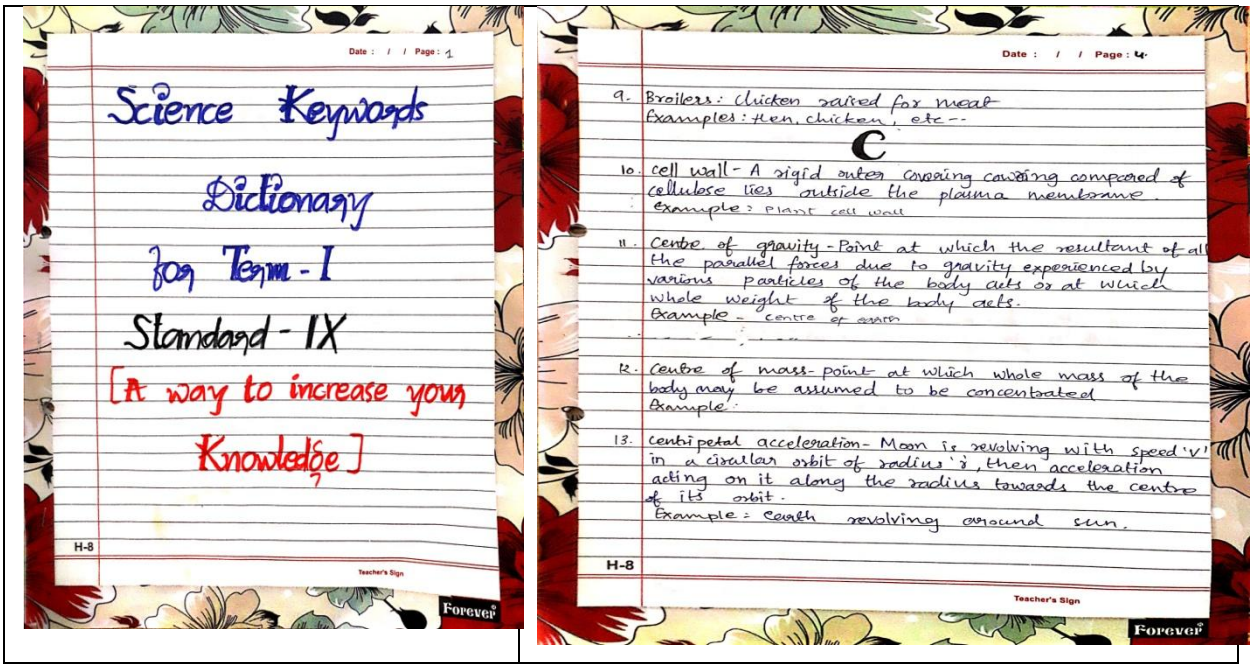

Fig.3.15 Science Key word Dictionary

For value knowledge and value perception of the students during science teaching, following activities were organized as an integral part of ViEL namely: Value games, Role plays, Value Cross word puzzle making, Value songs, exhibition of movie etc. along with Storytelling (7 stories)and character first education(www.characterfirstEd.com) activitiies like:message wheel,value cube etc. The story of Make the World a Better Place, The Starfish (Environmental ethics, Compassion), Jadav Payeng: The 'Forest Man of India (Learning to live together, Dignity of labour, equality, co-operation), Dashrath Manjhi: The Mountain Man (common goal, discipline, Simplicity), There is always something to be thankful for(Quest for Knowledge, curiosity, Flexibility, Tolerance) and Wise King(honesty) were told and discussed with learners. A sample story is illustrated in the box -1.

Box-1: Sample story for value inculcation

The Frog that Refused to Listen

Topic: Chapter-1 : Matter in our Surrounding

Subtopic: States of matter, Changes of state of matter

Value: Determination, discrimination

Some frogs arranged a climbing contest to the top of a very high tower. Lot of frogs gathered to see the race. The race began. The crowd did not believe anyone would reach the top of the tower. They started shouting, "Oh, way too difficult!"No one will ever make it to the top." "The tower is too high." The frogs began falling down, one by one.

The crowd present there shouted, "It is too difficult! .Some frogs believed that No one will make it" .By listening this more frogs got tired and gave up. But one continued to climb and after a big effort reached the top! All wanted to know how he managed to do it. Everybody came to know that the winning frog was deaf! Until we are deaf to other people's opinion about what is possible, we can never reach beyond the limits others set for us. Let us be deaf to those who keep telling us that it can't be done.

Story-2

Wise King

Topic: Ch.2.Is matter around us is pure ?
Subtopic: States of matter, Changes of state of matter
Value: Honesty

Once there was a king who wishes to hand over the reign to his successor. The king called his ministers and expressed his desire. Minister called a group of enthusiastic people for the said purpose form the kingdom. King while interacting with all prospective candidates for the throne, gave a seed to everybody and asked to grow a plant from the seed and bring plant after one year. Everybody returned home happily with the seed and the king was eager to know what happened to those called for the test. Kautilya was very humble, loving person and he used to water the seed every day, taking care of the seed nicely. Months passed by but to his surprise, nothing happened. He expressed the state of sadness to his mother and mother advised not to worry about it and take proper care of the seed. Everyday Kautilya used to keep the pot under sun, water it and see the soil but no sign of sprouting happened . Meanwhile king called all of the candidates after one year and Kautilya was hesitant to go as there was no plant in the pot. But his mother advised him to go to king's court and present the pot to the king. With lot many hesitation, he went to Kings Court and he saw every candidates were having full grown plants in their pots except him. He felt very upset and was worried about it because king may punish him as he failed to grow a plant from the seed. Finally the moment arrived; king saw all pots eagerly, pots full of plants and one pot without plant. King summoned Kautilya for the reason and Kautilya replied 'Your majesty, I tried my best but nothing happened to the seed'. King gazed at him and smiled and replied "How a boiled seed can sprout at all? All those are having plants in their pots are not original seed that I gave to everyone. You are the most honest man and I declare you to be the King of the kingdom as you have passed in my test. Others were dumbstruck by listening to king's announcement and felt ashamed about their misdoings.

During the same time the students of control group were taught science through their traditional method by their teachers.

Phase III: Post Testing

After the experimentation, post testing was done for both the experimental group and control group in the second week of October, 2016 in a similar manner like pretesting. Value knowledge test, value perception scale and achievement test in Science were administered on both the experimental group and control groups. The reaction scale was administered only to the students of experimental group to know their reaction towards the ViEL and its implementation. Apart from this post testing, the researcher observed the students of the experimental group during the whole period of experiment and recorded the specific events in the observation note cum teacher's diary. Anecdotal records of each student in the experimental group were also mentioned by the researcher.

3.8.0 PROCEDURE OF DATA ANALYSIS

For the purpose of data analysis, the investigator used statistical tools namely Mean, Standard deviation, standard error of mean, Mann -Whitney U test, Percentage, intensity index, in order to find out the impact of ViEL**.** The non-parametric test Mann-Whitney U-test was used to analyze the data as the sample was taken purposively, and it is considered as the most powerful non parametric equivalent of t-test of parametric family. Data collected through observation and anecdotal records were analyzed by using qualitative techniques like content analysis and triangulation. The detailed analysis and interpretation of the data is given in chapter IV.

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