Chapter Two

Plan & Procedure

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PLAN AND PROCEDURE

2.0 INTRODUCTION:

In this chapter, the investigator has detailed out the plan and procedures, of the study. The present study was an intervention study, where different strategies were developed catering to the learning styles of Std. VIII students and tried out to improve the instruction of science subject in real classroom setting. This chapter consists of research design of the study, tools, technique, procedure of data collection and data analysis.

2.1 RESEARCH DESIGN OF THE STUDY:

The present study was developmental cum experimental in nature. Different strategies were decided for broad spectrum of students learning styles in science subject. Based on these strategies an intervention program in the form of designed lesson plan was used for the treatment of experimental group.

	Pre test	***Treatment***	***Post test***
Group 1	.....	***X***	***O***
Group 2	.....	.....	***O***

X = Treatment **Group 1- Experimental Group (53 students)**

O = Observation **Group 2- Control Group (53 students)**

The present study was carried out in different phase as follows

- The investigator identified learning styles profile of the students using Index of Learning Styles (ILS) constructed by him.
- The investigator keeping in mind learning styles profiles of the class designed the instructional strategies.
- From the two sections of the Std. VIII, one section was taken as experimental group, where as, the other section as control group.
- The Investigator taught the experimental group using designed strategies, while another teacher taught comparison group using traditional method.
- After the treatment, post-test was administered on both the experimental and control groups, whereas, the attitude scale was administered on experimental group. Collected data was analyzed to study the effectiveness of the strategies.

2.2 NATURE AND SOURCE OF THE DATA

For objectives, one, three and four data were quantitative in the nature and the source of the data was Std. VIII Gujarati medium students studying in Kalarav School, Halol.

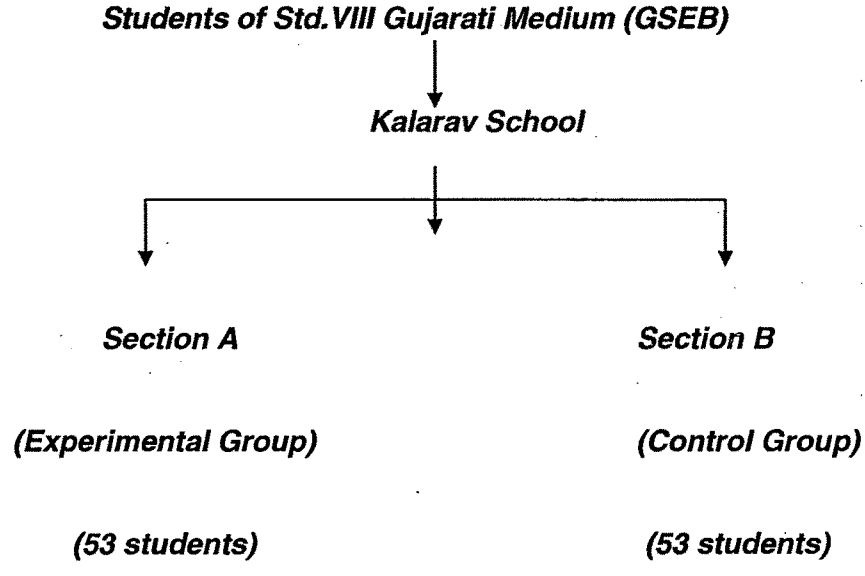
For objective two, the data was qualitative in the nature. It was collected from the various teachers and experts from the field.

2.3 POPULATION:

The population of the present study was all the Gujarati medium students of Std. VIII following Gujarat State Education Board Syllabus.

2.4 SAMPLE:

The present study was developmental cum experimental in nature. The investigator had to apply an intervention program on the students. The students of Kalarav School, Halol studying in Std. VIII Gujarati medium were selected using purposive sampling technique from the population. From two sections of std. VIII, section A was treated as experimental group and section B was treated as control group.



2.5 TOOLS

For the present study, the following tools were used for different purposes during the study.

1) Index of Learning Styles (ILS)

2) Science Attitude Scale (SAS)

3) Achievement Test

2.5.1 Index of Learning Styles (ILS)

There are many commonly known instruments to determine learning styles for e.g. Pat Waymans learning style inventory, Kolb's learning style inventory, Mayer-Briggs type of indicator etc.

Index of Learning Styles (ILS) is based on Felder-Silverman model of learning styles. It is used to identify learning preference of an individual (student) or group (Class).

The Felder-Silverman model (1988) categorizes learners on five dichotomous dimensions.

1) Sensing Vs Intuitive (Perception)

2) Visual Vs Verbal (Input)

3) Active Vs Reflective (Processing)

4) Inductive Vs Deductive (Organization)

5) Sequential Vs Global (Understanding)

It is very important to note that Richard Felder and Barbara Soloman (2002) already prepared the Index of Learning Styles (ILS) based on the same model. This is self-scoring instrument available on the website www.ncsc.edu. It was prepared for engineering students. Therefore, sentences of inventory are quite difficult to understand for high school students. Therefore, the investigator decided to prepare Index of Learning Styles (ILS) in Gujarati considering the same model as theoretical basis.

2.5.1(a) Preparation of ILS

In the original Index of Learning styles, Felder and Silverman decided to take only four dichotomous dimensions except inductive and deductive organization. They argued that inductive method is the only effective way of presenting the information at school level. One must use inductive approach and there is no question about deductive learners. Therefore, here also only four dimensions are used for ILS. By going through each dimension comprehensively, the investigator carefully prepared nine statements for each dimension. So overall 36 statements were prepared for ILS. All the statements were arranged randomly. Each statement has two options. Selection of any one option is necessary.

2.5.1(b) Scoring of ILS

In the Index of Learning Styles, there are 36 statements. All the 36 statements of ILS represents following dimensions. Sensing (S), Intuitive (I), Visual (Vs), Verbal (Vb), Active (A), Reflective (R), Sequential (Sq) and Global (Gb).

Table: 2.1 Scoring Keys for Index of Learning Styles

Statement No	Option-a	Option-b
1	S	I
2	Vb	Vs
3	R	A
4	Sq	Gb
5	Sq	Gb
6	R	A

7	Vb	Vs
8	I	S
9	S	I
10	Vs	Vb
11	R	A
12	Gb	Sq
13	Sq	Gb
14	A	R
15	Vb	Vs
16	S	I
17	I	S
18	Vs	Vb
19	A	R
20	Gb	Sq
21	Gb	Sq
22	A	R
23	Vb	Vs
24	S	I
25	S	I
26	Vb	Vs
27	A	R
28	Sq	Gb
29	S	I
30	Vb	Vs

31	R	A
32	Gb	Sq
33	I	S
34	Vs	Vb
35	A	R
36	Sq	Gb

Table: 2.2 Summary of the Scoring Keys of the Statements of Index of Learning Styles:

Dimension	**Statement No**	**Total**
Sensing/Intuitive	1, 8, 9, 16, 17, 24, 25, 29, 33	9
Visual/Verbal	2, 7, 10, 15, 18, 23, 26, 30, 34	9
Active/Reflective	3, 6, 11, 14, 19, 22, 27, 31, 35	9
Sequential/Global	4, 5, 12, 13, 20, 21, 28, 32, 36	9
Total		**36**

Imagine each dimension of ILS as a two-pan scale, with each pan representing one of the two categories of the dimension(for example, sensing and intuiting), and weights in a pan representing skill associated with the category. If you prefer sensing it means you have more weights in the sensing pan than intuitive pan, and conversely if you prefer intuition.

Some people have strong preference for one category say, sensing, over the other (they give greater weightage to the sensing pan than to the intuitive pan). Those people will choose the sensing alternative on most of the nine questions on the ILS that have to do with sensing/intuitive dimension. They will get a high score (7 or 9) for sensing. Others for whom the preference for sensing still exist but is not so strong will choose a few intuitive responses. They will get an immediate score (3 or 5) for sensing, still others who prefer sensing are closely balanced. In situation that calls for behaving like a sensor or like an intuitor, they are almost equally likely to get either way. They will end up choosing some sensing alternatives almost as many intuitive alternatives and end up with score one (1) for sensing. It just means you are well balanced on the dimension.

ILS users should be aware of two important points

1) The ILS results provide an indication of an individual's learning preference and even better indication of the profile of a group of students, but these should not be over interpretted. If some one does not agree with ILS assessment for his or her preference, trust the individual's judgment over instrument result.

2) A students learning styles profile provides an indication of possible strengths and possible tendencies or habits that might lead to difficulty in academic settings. The profile does not reflect a student's suitability or unsuitability for particular discipline, subject or profession. Labeling students in this way is at best misleading, and can be destructive if the student uses the label as justification for a major shift in curriculum or career goals.

2.5.1 (c) Validity and Reliability of the Instrument

Validity of the tool in accordance with the dimensions of learning styles through expert's opinion was the next step during the construction of the learning styles inventory. The basic objective was to confirm that the prepared test items were really measuring all the dimensions of learning styles intended for. The expert's feedback on the tool not only help in validating the tool but also highlighted the difficulty level.

The test retest reliability was established for the tool. The students of Std.VIII studying during the year 2005-06 were selected as the sample. The coefficient of correlation was found 0.80. It shows the high positive correlation between the scores.

2.5.2 Science Attitude Scale (SAS)

Science attitude scale was used to measure students' attitude towards science subject. It is important to note that this scale is not similar to scientific attitude scale. The scale was deliberately prepared for high school level students.

2.5.2 (a) Construction of the SAS

The tool to measure the attitude of students towards the science subject was constructed by the investigator. It was constructed by following "the method of summated rating" given by Likert (1932).

An attitude scale consists of a number of items that have been carefully prepared, selected and edited according to certain criteria. Items of attitude scale are called statements. An individual responds to these statements by indicating his/her agreement or disagreement with which he or she agrees.

2.5.2 (b) Identification of the Components of SAS

After thoroughly exploring the literature available on science attitude scale the following components and behaviors were identified.

1) Self confidence in the subject

- Confidence of getting good marks
- Confidence in the subject related activities

2) Usefulness of the subject

- Usefulness of the subject for better future
- Value of the subject according to students

3) Enjoyment in the subject

- Enjoyment during the class
- Enjoyment in the subject related activities

4) Motivation

- Progress in the subject
- Enthusiasm for further progress

5) Students' perception of teacher

- Teacher's behavior towards the students
- Teacher's image for the students

These identified components of science attitude scale with list of behaviors under each of them were referred to subject experts in the field. This exercise

was carried out to collect the opinion of the experts on the identified components and the behaviors regarding their

1) Appropriateness 2) Relevance 3) Capacity

Most of the experts agreed to the identified components and listed behaviors.

2.5.2 (c) Format and Nature of the Statements

Statements were prepared for all the components by considering the behaviors under that component. All the statements were easy to understand. All the items were provided with five options namely, strongly agree, agree undecided, disagree and strongly disagree. Following are the components of statements of SAS.

- S= Self confidence in the subject
- U= Usefulness of the subject
- E= Enjoyment in the subject
- M= Motivation
- T= Student's perception of the teacher

Table: 2.3 Distribution of the Statements of SAS according to Components and Polarity

Statement No.	Component	Polarity
1	S	+
2	U	-
3	E	+
4	M	-
5	T	-

6	S	-
7	U	+
8	E	-
9	M	+
10	T	+
11	S	-
12	U	+
13	E	_
14	M	+
15	T	-
16	S	+
17	U	-
18	E	-
19	M	+
20	T	+
21	S	-
22	U	+
23	E	-
24	M	+
25	T	-
26	S	-
27	U	-
28	E	+
29	M	-
30	T	-
31	S	+
32	U	+
33	E	+
34	M	-
35	T	+
36	S	+
37	U	+
38	E	-

39	M	+
40	T	+
41	S	-
42	U	+
43	E	+
44	M	+
45	T	+
46	S	+
47	U	+
48	E	-
49	M	-
50	T	-

Table: 2.4 Summary of the Statements

Component	+Ve	-Ve	Total
S	5	5	10
U	7	3	10
E	4	6	10
M	6	4	10
T	5	5	10
Total	**27**	**23**	**50**

2.5.2 (d) Tryout of Science Attitude Scale

To make a selection from the pool of fifty statements a tryout study was conducted on a sample of 379 students during the November month of 2006. The schools, which were selected for final sample, not included for this purpose.

Table: 2.5 Distribution of the Sample of Students Considered in Selection of Statements for Science Attitude Scale

Sr.No.	Name of the School	Location	Number of Students	Total
1	The M.S. High School, Halol Di: PMS	Urban	109	**209**
2	V.M. High School, Halol Di: PMS	Urban	100	
3	Nutan Vidyalaya, Navakuva, Di: PMS	Rural	80	
4	Mahakali Sarvajanik High School, Pavagadh, Di: PMS	Rural	55	**170**
5	S.H. Varia High School Ghoghamba Di: PMS	Rural	35	
	Total students			**379**

2.5.2 (e) Scoring Procedure

As has been mentioned earlier the scoring procedure of was according to the method suggested by Likert

For SA ⟶	5	SA= Strongly Agree
A ⟶	4	A= Agree
UD ⟶	3	UD= Undecided
D ⟶	2	D= Disagree
SD ⟶	1	SD= Strongly Disagree

Accordingly, the maximum score attainable was 250 on the scale and minimum possible score was 50. With the above guidelines followed for scoring, the responses were scored and summated scores in respect of each respondent were arrived at. The data was utilized for the selection of the statements.

2.5.2 (f) Selection of the Statements

For finally selecting statements that would differentiate between the high group and low group under mentioned procedure suggested by Likert (1932)

- The investigator considered the frequency distribution of scores based upon their responses to all statements. Then 27% of the subjects (NH= 100) with highest total score and 27% of the subjects (NL=100) with lowest total scores were selected for item analysis. They were termed as high and low groups.
- In evaluating the responses of high group and low group on each statement 't' values were computed by using following formula:

$$t = \frac{X_H - X_L}{\sqrt{\frac{S_H^2}{N_H} + \frac{S_L^2}{N_L}}}$$

Where

X_H = the mean score on a given statement for high group

X_L= the mean score on a given statement for low group

S_H^2= the variances of distribution of responses of high group to the statement

S_L^2= the variances of distribution of responses of low group to the statement

N_H= the number of subject in the high group

N_L = the number of subject in the low group

Table: 2.6 The Mean, Sd and't' Value of the Statements

After employing Science Attitude Scale on the sample of 379 students according to the Likert's method their Mean, Sd and't' value were found out. These are given in following table.

Stat. No.	Upper Mean	Lower Mean	Upper Sd	Lower Sd	t- value
1	4.14	3.14	1.24	1.44	5.27
2	3.21	2.61	1.53	1.40	2.93
3	4.28	3.58	0.99	1.36	4.08
4	3.76	2.85	1.254	1.252	5.4
5	4.13	3.42	1.134	1.319	3.9
6	3.43	2.84	1.409	1.412	3.08
7	4.14	3.34	1.064	1.335	4.71
8	4.47	2.65	0.969	1.174	11.29
9	4.02	2.73	1.189	1.270	7.64
10	4.10	3.10	1.267	1.432	5.10
11	4.10	2.68	1.150	1.413	7.80
12	4.62	3.86	0.874	1.128	5.10
13	3.41	2.85	1.471	1.399	2.72
14	4.11	2.70	1.150	1.280	8.40

15	4.13	3.42	1.134	1.319	3.9
16	3.71	2.79	1.499	1.380	4.87
17	4.64	3.81	0.894	1.152	5.5
18	3.80	2.77	1.407	1.370	5.37
19	3.5	3.13	1.521	1.346	1.8
20	4.32	3.65	0.909	1.218	4.45
21	3.46	2.46	1.329	1.283	4.88
22	4.1	3.81	1.078	1.178	1.75
23	3.48	3.02	1.337	1.341	2.55
24	4.62	3.54	0.895	1.367	6.95
25	4.78	3.93	0.705	1.265	5.69
26	3.88	3.39	1.148	1.238	3.07
27	4.52	3.08	0.998	1.39	8.61
28	4.28	3.13	1.064	1.397	6.27
29	3.47	2.89	1.141	1.286	3.27
30	3.59	3.21	1.173	1.387	2.13
31	3.81	3.08	1.080	1.236	4.67
32	4.55	2.98	0.947	1.348	10.43
33	4.56	2.85	0.946	1.403	10.88
34	3.10	2.47	1.514	1.306	3.00

35	4.47	3.02	0.958	1.421	8.87
36	4.38	3.90	1.003	1.087	3.13
37	3.80	3.01	1.318	1.251	4.26
38	4.791	3.72	0.624	1.223	7.53
39	4.12	3.19	1.037	1.323	5.56
40	3.43	3.01	1.423	1.322	2.26
41	3.59	3.11	1.498	1.355	2.37
42	4.20	3.36	1.025	1.257	5.33
43	4.10	2.68	1.150	1.413	7.80
44	4.04	2.72	1.197	1.198	7.79
45	2.64	2.27	1.514	1.179	1.89
46	4.12	3.11	1.192	1.385	5.23
47	4.02	2.73	1.189	1.270	7.84
48	4.10	3.10	1.267	1.432	5.10
49	4.47	2.65	0.989	1.274	11.30
50	3.63	3.15	1.276	1.306	2.56

For the final selection of the statements following criterion suggested by Likert " the 't ' value of the any statement equal or greater than 1.75 indicating that the average response of the high and low group to a statement differs

significantly, provided we have 25 or more subjects in the high and also in the low group".

In the table't 'value of all the statements is 1.75 or above, thus all the statements were selected for final test.

2.5.2 (g) Validity and Reliability of SAS

The finally prepared attitude test was shown to the experts in the field inviting their comments on the language and appropriateness of the tool for the purpose intended by the investigator. Later on test – retest reliability was established by the investigator. The correlation value was 0.83. This shows high positive correlation between test and retest.

2.5.3 Achievement Test (Post -Test)

For the post-test, the investigator prepared achievement test to measure student's achievement in the science subject. The achievement test was constructed using Science and Technology textbook of stranded VIII prepared by the Gujarat State Textbook Board. The test was prepared on only five chapters out of fifteen chapters of the textbook. There are different types of questions in the test. For the construction of the test, prescribed blueprint of the State Board was used.

Table: 2.7 Marking Scheme of Achievement Test (Post Test)

Question No	Question type	No of sub questions	Total marks
1	Multiple Choice	6	6
2	Objective type	6	6
3	Short question	7	14
4	Answer in brief	4	12
5	Answer in detail	3	12
Total (5)		26	**50**

The prepared test was shown to the experts for content validity and for examining language, content and framing of questions. Modifications were carried out according to suggestions give by the experts in terms of content, language and framing of the questions.

2.6 DATA COLLECTION

The investigator is working as a science teacher in Kalarav school, Halol Di: Panchmahal (Gujarat). He decided to conduct the study in the same school. In order to get the permission for conducting the study he met the Principal of the school and Managing Trustee of the school. They told him to give a copy of research proposal and a letter for granting permission. After their permission, the investigator started preparing the tools. The data were collected in three phases.

- Pre-intervention phase
- Intervention phase
- Post intervention phase

Pre-intervention Phase

The investigator developed Index of Learning Styles (ILS) and learning strategies catering to learning styles. A very few studies were carried out in this area. Therefore, it was necessary for him to check the workability of the tool and designed strategies.

The investigator decided to carry out a pilot study. After constructing the tool (ILS), he met the experts from the field and made the necessary modifications. He employed that tool on students of Std. VIII studying in 2005-06 in order to know their learning styles profile. After getting the profile, he selected five chapters from Std. VIII Science and Technology textbook prepared by Gujarat State Textbook Board. He analyzed the contents of those chapters and prepared strategies (incorporated in the lesson plans) for only one chapter (Universe). The prepared strategies were shown to the various experts from the field to gauge the workability of those strategies. Those strategies were applied on the students studying in Std. VIII during the year 2005-06. Through that pilot study, the investigator got feedback for himself. He made necessary modifications and prepared similar strategies in terms of designed lesson plans for other four chapters.After preparing all the tools, the investigator collected demographic data of all the students studying in Std. VIII during the year 2006-07 in the beginning of the term.

Intervention Phase

The investigator started teaching 53 students of experimental group studying in Std. VIII in the year 2006-07 from the starting of the term (June 2006). It took almost three months to complete the five chapters. During this phase sometimes, the investigator also observed the teaching in control group.

Post- intervention Phase

The investigator administred achievement test (posttest) and Science Attitude Scale on both the groups and collected the data in order to know their achievement scores and attitude scores.

2.7 DATA ANALYSIS

All the collected data were analyzed by using different statistical techniques in order to study the effectiveness.

For objective, one data was analyzed using frequency and percentage count.

For objective three data was analyzed using ANCOVA. The calculation of ANCOVA was done using computer software.

For objective four t-score was calculated using computer software.