Chapter Five

Summary, Conclusion & Suggestions

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5.0 INTRODUCTION

In the traditional teaching learning process students preferentially take in and process information in different ways by seeing and hearing, reflecting and acting, reasoning logically and analyzing intuitively, steadily and in fits and starts. To understand learning styles just think how a learner prefers to learn new things.

According to Claxton and Raltson (1978), "Learning styles refer to individual's response to learning environment". Dunn and Griggs (1998) describe learning style as the way an individual begins to concentrate on, processes, internalizes and remembers new information and skills. They reported that learning style is an individual's reactions to several factors.

Different authors categorized learners in different ways. Based on these various learning styles models are presented. On the other hand, teaching methods also vary. Some instructors employ lecture method others demonstration, where as some lead students to self-discovery. Some focus on principles and others on application, some emphasize on memory and others understanding. The difference between teaching styles of the teacher and learning styles of the students causes serious difficulties in the teaching learning process. The students may become bored and inattentive in the classes, do poorly in the test, get discouraged about the courses, change to other curricula, and dropout of the school. Teachers are confronted by low grades, unresponsive or hostile classes, poor attendance and dropouts. They begin

to wonder if they are in right profession. Thus, society looses potentially excellent professionals.

Traditional instructional strategies seem to be out dated, especially for science subject because of the 'nature of the subject'. Students translate many abstract concepts in science into concrete mental images. However, sometimes, instruction is not catering to their learning styles. The NCERT (1990) recommended that appropriate instructional strategies be expected to be adopted in classroom, which would lead to spread scientific awareness among the learners.

In an attempt to match, the teaching styles and learning styles Richard Felder(1996) developed a parallel model of teaching styles (appropriate instructional strategies) according to learning styles that seems to apply well on students in technical discipline. This needs to be explored in science subject also.

To provide frameworks for growing number of learning style theories different learning styles models are presented. Taking the inspiration from all these models Richard M. Felder a Chemical Engineering Professor at North Carolina University and Linda K.Silverman an Educational Psychologist at the University of Denver developed a comprehensive learning styles model. It is known as Felder-Silverman model of learning styles.

5.1 FELDER-SILVERMAN MODEL OF LEARNING STYLES

According to Felder- Silverman learning styles model (1988) a students' learning styles may be defined in part by answering the following five questions.

1) What type of information does the student preferentially perceive: sensory (sights, sounds, physical sensations) or intuitive (memories, ideas, insights)?

2) Through which modality is sensory information most effectively perceived visual (pictures, diagrams, graphs, demonstrations) or verbal (sounds, written and spoken words and formulas)?

3) With which organization of information is the student most comfortable: inductive (facts and observations are given, underlying principles are inferred) or deductive (principles are given, consequences and applications are deduced)?

4) How does the student prefer to process information: actively (through engagement in physical activity, discussion) or reflectively (through introspection)?

5) How does the student progress towards understanding: sequentially (in a logical progression of small incremental steps) or globally (in large jumps, holistically)?

Following are the dichotomous dimensions of the Felder-Silverman model of learning styles.

1) Sensing and Intuitive Perception

People are constantly being bombarded from both their senses and their subconscious mind. The volume of this information is much greater than they can consciously attend to. They therefore, select a minute fraction of it, admit to their "working memory" and the rest of it is effectively lost. In making, this selection sensing learners (sensors) favor information that comes in through their senses and

intuitive learners (intuitors) favor the information that arise internally through memory reflection and imagination.

Sensors tend to be practical while intuitors tend to be imaginative. Sensors like facts and observations, intuitors prefer concepts and interpretations. A student who complains about the course nothing to do with real world is almost certainly a sensor. Sensors like to solve the problems using well established procedures, don't mind detailed work, and don't like unexpected twist and complications, while, intuitors like variety in their work, don't mind complexity, and get bored with too much detail and repetition. Sensors are careful but may be slow. intuitors are quick but may be careless. Sensing learners learn best when given facts and procedures, but subject like Science and Maths mostly focus on the abstract concepts, theories, and formulas putting sensors at a distinct disadvantage. Moreover, sensors are less comfortable than intuitors with symbols. Since most of the words and algebraic variables are symbolic, sensors must have to translate them into concrete mental images in order to understand them. This process can be lengthy one. The net result is that sensors tend to get lower grades then intuitors when information is given through lecture method.

2) Visual and Verbal Input

Visual learners get more information from visual images (pictures, diagrams, graphs, demonstrations) than from verbal material (written and spoken words and mathematical formulas). If something is simply said and not shown to visual learners (e.g. in a lecture based class) then there is a chance that they will not retain it.

Presumably, most of the students in the classes are visual learners while the information presented in almost every lecture course is overwhelmingly verbal, written words and formulas in text and on the chalkboard, spoken words in the lectures, with only an occasional use of diagrams, charts or demonstration breaking the pattern. Teacher should not be surprised when many of their students cannot reproduce information that was presented to them not long before. It may have been expressed but it was never heard.

3) Inductive and Deductive Organization

Inductive learners prefer to learn a body of material by seeing specific cases first (observations, experimental results, numerical examples) and working up to governing principles and theories by inferences, while deductive learners prefer to begin with general principles and deduce consequences and applications. Since deduction tends to more concise and orderly than induction, student who prefers to learn structured presentation are likely to prefer deductive approach while, those who prefer less structured are likely to favor induction.

Researches show that of these two approaches to education, induction promotes deeper learning and longer retention of information and gives students greater confidence in their problem solving abilities. On the other hand, it is observed that generally our instruction is, highly deductive may be because deductive presentations are easier to prepare, control, and allow more rapid coverage of material.

4) Active and Reflective Processing

Active learners tend to learn while doing something actively, trying something active, bouncing ideas of others while, reflective learners do much more introspectively, thinking things through before trying them out. Active learners work well in groups while reflective learners prefer to work alone. Unfortunately, most of the lecture courses do very little for either group. The active learner never gets to do anything and the reflective learners never have time to reflect. This leads to inattention and passivity.

In a number of studies comparing instructor centered classes (lecture and demonstration) have been compared with student centered (problem solving and discussion). Lectures are found to be more effective when students are tested on short-term recall of facts but the active classroom environments are found superior when the criteria involved comprehensive, long-term recall, general problem solving ability, scientific attitude and subsequent interest in the subject. Benefits are also cited for teaching method that provides opportunities for reflection, giving students time in class to write brief summaries and formulate written questions about the material just covered.

5) Sequential and Global Understanding

Sequential learners absorb information and acquire understanding of material in small connected chunks, while, global learners achieve understanding in large holistic volume. Sequential learners can solve the problem with incomplete understanding of the material but they may find difficulty in grasping the big picture,

the broad context of a body of knowledge and it's inter relationships with other subjects and disciplines. Global learners learn in a more all-or-nothing fashion and many appear slow and do poor in their homework and test until they grasp the total picture, but once they have it they can often see connections to other subject.

Before global learners can master the details of a subject they need to understand how material being presented relates to their prior knowledge and experiences, but only exceptional teacher routinely provides such a broad perspective on their subjects.

5.2 STATUS OF SCIENCE INSTRUCTION IN THE CLASSROOM

Science is one of the activities that human beings have created to gratify certain needs, interest and desires. It is a disciplined way of seeking knowledge. For an education built up on reasoning, experimentation and problem solving skills, Science is considered particularly suitable. The subject deals with many abstract concepts, phenomena and equations. Generally, it is observed that instruction given in the science subject in most of the schools is verbal, intuitive and highly deductive, causes serious difficulties in grasping the subject. According to Marzin (1987),Rigden (1991),Smith (1991) nature of the subject matter and content have been stated to be important for selection of appropriate instructional strategies. Results have shown that the teachers find the lecture method as the most appropriate for transaction of curriculum in classroom. In this context, it should be recalled that traditional positivistic presentation of Science knowledge and teaching are considered inadequate as means of understanding the social aspects (Fleck 1979, Latour 1989, Tobin et al 1990). In case of Science teaching, it is important to

stress on different aspects of Science as a body of knowledge, as a way of thinking (NCERT,1990, NPE-86). In this context, lecture method as an instructional strategy, is said to have limitations in developing the connection between the experimental evidential supports as expressed by Sinner (1992).

Thus, it is very necessary to adopt such instructional strategies in science subject , which match with the learning styles of students.

5.3 RATIONALE OF THE STUDY

In the multivariate setting of a classroom, it is very difficult for a teacher to take care of all students equally according to their individual needs. Teacher cannot satisfy all the students while instructing in the classroom. Unfortunately, most of us have been accustomed to traditional teaching learning process, where one who knows (teacher) presents ideas to one who does not know (students), where the focus is on convergence of materials. The lecture method tilts heavily towards the small percentage of students who are intuitive, verbal, deductive, reflective and sequential. The imbalance puts sizable fraction of the students population at disadvantage. Sensing, visual, inductive, active and global learners rarely get their educational needs met in their school subjects. If the mismatches are extreme between teaching styles and learning styles students are apt to loose their interest towards the subjects.

A teacher is expected to have a teaching style that will apply to all the students effectively. For that it is essential to understand 'how each student or class learns best'(learning styles) and design instructional strategies accordingly to satisfy the broad spectrum of learning styles.

Especially Science subject is full of abstract concepts, such as movement of electrons, cell division, astronomy, atoms, molecules etc. Therefore, students find difficulty in understanding the concept if it is not presented visually. Similarly, there are some equations, which should be derived from concrete information inductively, and one of the aims of Science Education is that it should be related to day-to-day life. However, in most of the schools the instruction is passive, lecture based, deductive and intuitive. Thus, society looses the potentially excellent professionals and scientists. Therefore, it is very necessary to design instructional strategies in science subject, which cater to the broad spectrum of learning styles.

The review of literature suggests that similar studies are conducted in this area but most of the studies were carried out abroad and in engineering field. Similar study taken up by Felder.R.(1990), found that the method constituted the experimental instruction approach have shown significant positive effect on students academic performance, motivation to learn, attitude towards the subject and they have experienced greater improvement in their basic creativity and problem solving ability. So, it is needed to explore it at school level. In India, secondary school level is very important for any student to build the career and further interest towards the subjects. Std VIII is the doorstep of secondary level and from the year, 2004 GSEB introduced a new CBSE pattern syllabus in VIII Std. Therefore, it is necessary to conduct this type of study right from the beginning of secondary level to develop student's interest towards the Science subject.

5.4 STATEMENT OF THE PROBLEM

Evolving Instructional Strategies on Science Subject Catering to the Learning Styles of Standard VIII Students

5.5 OBJECTIVES

1) To identify the learning styles of Std VIII students.

2) To design instructional strategies on science subject catering to the learning styles of std VIII students.

3) To study the effectiveness of the designed instructional strategies in terms of achievement of students.

4) To study the attitude of students towards the science subject after the implementation of designed instructional strategies.

5.6 OPERATIONAL DEFINITION OF THE TERMS USED

Learning Style: It is composite of characteristic cognitive, affective, and physiological factors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment.

Evolving: It stands for designing, developing and implementing instructional strategies in the context of present study.

Instructional strategies: Instructional strategies are suitable methods and media, employing the potency of ET and ICT.

5.7 HYPOTHESES

(1)There will be no significant difference in the adjusted mean achievement scores of experimental group and control group.

(2)There will be no significant difference in the attitudes of experimental group and control group towards the science subject after the implementation of designed instructional strategies.

5.8 DELIMITATION OF THE STUDY

The present study is delimited to Std VIII Gujrati Medium Student of Kalarav School, Halol in the year 2006-2007. The instructional strategies were designed on Science subject only.

5.9 NATURE OF THE STUDY

The study is developmental cum experimental (two groups post- test). It was carried out in different phases.

5.10 DESIGNING STRATEGIES CATERING TO THE LEARNING STYLES OF STUDENTS

The investigator designed the strategies (In the form of lesson plans) by keeping in mind the learning styles profile of the class. Felder (1988) in his article "learning and teaching styles in Engineering Education" suggested a few strategies to match

diverse learning styles with teaching styles. These strategies were also used to frame the lesson plans for the science subject.

1) Teach theoretical material by first presenting phenomena and problems related to the theory (sensing, inductive, global)

2) Balance conceptual information (intuitive) with concrete information (sensing). Intuitors favor the conceptual information, theories, mathematical models, and material that emphasize fundamental understanding. Sensors prefer concrete information such as descriptions of physical phenomena; results form real and simulated experiments, demonstration and problem solving algorithms.

3) Make extensive use of sketches, vector diagrams, computer assisted learning material and physical demonstrations (visual) in addition to oral and written explanations and derivations in lecture and reading.

4) To illustrate an abstract concept use at least one numerical example (sensing) to supplement the usual algebraic example.

5) Use physical analogies and demonstrations to illustrate the magnitudes of calculated quantities (sensing and global). e.g. tell students to think of 1oo microns are about the thickness of sheet of paper.

6) Occasionally give some experimental observations before presenting the general principle and see how far they can infer the latter (inductive).

7) Provide class time for students to think about material being presented (reflective) and active students participation (active).Occasionally pause during a lecture to allow time for thinking and formulating questions and allow "one minute papers" near the end of the period, having students write on the index cards the

lectures most important points and the single most brief group solving exercises in the class.

8) Encourage co-operation on homework (for every category). Hundreds of research studies show that students who participate co-operative learning tend to earn better grades, display more enthusiasm for their chosen field.

9) Demonstrate the logical flow of individual course topics (sequential), but also point out connections between the current material and the other relevant material in the same disciplines in every day experiences (Global).

10) Use discovery method and project based learning for maximum topics, because these methods are useful for all type of learners.

11) Use various computer based educational softwares in routine teaching.

12) Use PowerPoint presentations for teaching of different topics in the science. Collect pictures and video clips from various resources like web and Microsoft Encarta.

The investigator decided to incorporate these strategies in daily teaching-learning process in the form of lesson plans. From Science and Technology text book of Std. VIII five chapters were selected according to abstractness and difficulty level of the content. The opinion of the previous year students was also taken into consideration while deciding the chapters.

The following chapters were selected for designing the strategies based lesson plans.

1) Universe

2) Soil

3) Cellular organization

4) Properties of matter

5) Refraction of the light

Investigator analyzed the contents of all the chapters and decided the suitable methods and media for diverse learning styles. Designed lesson plans were shown to the experts from the field. The investigator decided to use lesson plans of one chapter (Universe) for pilot study on students studying in Std.VIII in the year 2005-06. According to the feedback, the investigator made necessary changes and modifications in final plans.

5.11 POPULATION AND SAMPLE

All the Gujarati medium schools following Gujarat State Board Syllabus were the population for the study. From the population Kalarav school was selected purposively. From two sections of Std. VIII one section was treated as experimental group, whereas, the other section was treated as control group.

5.12 TOOLS

1) Index of Learning Styles (ILS) in Gujarati

Subjective self-assessment questionnaire or more objectively psychologist directly observing a subjects behavior in laboratory situation assesses learning styles. Second way is very complex and very difficult to take the right judgment of one's learning styles. Questionnaires and inventories are used as most common means for assessment of learning styles. However, these demonstrate several weaknesses.

- Lack of objectivity
- Inaccuracy in reporting
- Bias in reporting due to peer pressure
- An inclination to contrive responses

All the inventories are based on the particular models of the learning styles. These models are theoretical basis of these various inventories. There are many commonly known instruments to determine learning styles. For example, Pat Wayman's learning style inventory, and Kolb's learning style inventory and Mayer-Briggs type of indicator.

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. The items of inventory are quite difficult to understand for high

school students. It was also difficult to translate through local language (Gujarati). Therefore, the investigator decided to prepare Index of Learning Styles(ILS) in Gujarati considering the same model as theoretical basis.

❖ Preparation of ILS in Gujarati

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 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 a must.

❖ Scoring of ILS

The options of all the 36 statements of ILS (Gujarati) represent following dimensions given in the table.

Here following symbols are used for different dimensions of the learning styles. Sensing (S), Intuitive (I), Visual (Vs), Verbal (Vb), Active (A), Reflective (R), Sequential (Sq), and Global (Gb).

Table 5.1: Distribution of components of learning styles in ILS

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 have more weights on the sensing pan than in intuitive pan). Those people choose the sensing alternative on most of 9 questions on the ILS that have to do with sensing/intuitive dimension, and they will get a high score (7 or 9) for sensing. Others for whom the preference for sensing still exists 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.

- 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 they should not be over interpreted. If some one does not agree with ILS assessment for his or her preference, trust the individual's judgment over instrument result.
- A student's learning style 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 students suitability or unsuitability for particular discipline, subject or profession. Labeling students in this way is at best misleading, and can be destructive if the students use the label as justification for a major shift in curriculum or career goals.

❖ 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 if the prepared test items were really measuring all the dimensions of learning styles they were intended for. The expert's feedback on the tool not only helped 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) Science Attitude Scale (SAS)

❖ Construction of the Tool

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).

❖ Identification of the Components

After thoroughly exploring the literature available on science attitude scale to measure the attitude towards science subject. 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) Student's 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 component and the behaviors regarding their

- Appropriateness
- Relevance
- Capacity

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

❖ Format and Nature of the Statements

Statements were prepared for all the components by considering the behaviors under that component. All the statements are easy to understand. All the items were provided with five options, namely, Strongly Agree (SA), Agree (A), Undecided (UD), Disagree (D) and Strongly Disagree (SD).

Table 5.2: Distribution of the Statements of SAS According to Components and Polarity

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**

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

❖ 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 were not included for this purpose.

❖ Scoring Procedure

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

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 score in respect of each respondent was arrived at. The data were analyzed for the selection of statements.

❖ 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 up on 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

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.

❖ Validity and Reliability

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, which shows high positive correlation between test and retest.

3) Achievement Test (Post-Test)

For the post-test, the investigator constructed achievement test to measure students' achievement in the Science subject. The achievement test was constructed using Science and Technology textbook of Std.VIII prepared by the Gujarat State Textbook Board. The test was prepared on five selected 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 5.3: Summary of the Achievement Test

Question No	Question type	No of 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		**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 given by the experts in terms of content, language and framing of the questions.

5.13 DATA COLLECTION

The investigator is working as a science teacher in Kalarav School, Halol Di: Panchmahal (Gujarat). He decided to conduct a study in the same school. In order to get the permission for conducting the study the investigator 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 to prepare 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) in Gujarati language 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 those 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. He made necessary modification and prepared similar strategies for other four chapters.

After constructing all the tools and preparing the strategies, 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 selected five chapters. During this phase, the investigator also observed the teaching in control group.

❖ Post intervention phase

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

5.14 DATA ANALYSIS AND FINDINGS

The collected data were analyzed through frequencies, percentage responses, ANCOVA and 't'test.

A. Learning Styles of the Students

- 17% of students were found to have a sensing preference. These students tend to perceive information in a concrete factual way, and are less comfortable with theories and abstraction. They are good with details and memorization. Most lecture courses however, are more intuitive in content introducing concepts. Students with sensing preference can be helped during lectures by inclusion of concrete examples and by demonstration of direct applicability of material to life.

- About half of the students were found to have preference of visual Inputs. In which (13%) students have strong or very strong preference for Visual Inputs. The lecture format is exclusively a verbal means of communication. Therefore, many visual learners will be hindered from effective learning in class. This is compounded by textbook with negligible visual component in the form of charts, graphs, tables, maps and diagrams. Increasingly, Indian middle class children are growing up watching hours of TV, and interacting with complex visual imagery in computer game animations. Their visual bias is thus further accentuated. For this type of learners, more and more visual aids (OHP, LCD Projector with Multimedia computer, charts, pictures, and graphs) should be used during the class.

- 61% of students process new information in an active manner. More than half of the class finds it hard to learn through the lecture method, as they need to actively process new material. To help to compensate and ensure that active learners remain active in class, the use of buzz sessions, group discussion and students participation in the class will help. Group homework and project work will particularly enhance the learning experiences of active learners. Some

students also have reflective processing preference, which are also not catered in traditional way of teaching. This type of learners should be encouraged in the class to give the reflections.

- The majority of the students (80%) demonstrated a global preference in understanding new material. 13% of them have strong or very strong preference for global understanding. They need to get big picture before the detail can fit in to the place. The majority of lecture courses are taught in a sequential step-by-step manner; logically and linearly, the course leads the students through new material. To assist the learning of the globalists we need to present the 'big picture' to them at the introduction of the course. We need to facilitate the ongoing integration of the course we are teaching with the overall curriculum, rather than teaching our course in 'isolation'.

B. Effectiveness of Designed Instructional Strategies in terms of Achievement in Science

The F-value of 34.59 has been found significant at 0.01 level. The adjusted mean achievement score 38.24 of the experimental group has been found significantly different from adjusted mean achievement score 31.92 of the control group. It means that the treatment was found significantly effective.

Therefore, the null hypothesis "there will be no difference in the adjusted mean achievement scores of experimental group and control group" stands rejected.

C. Effectiveness of Designed Instructional Strategies in terms of attitude towards the Science

The calculated "t-value" of 7.579 is higher than table value 2.63 at 0.01 level. Therefore, the null hypothesis "There will be no significant difference in the

attitudes of experimental group and control group towards the subject after the implementation of designed instructional strategies" was rejected. It means there is a difference in the attitude of experimental and control group towards the science subject. Experimental group demonstrated greater positive attitude towards the science subject

5.15 IMPLICATIONS OF THE STUDY

The present study has many implications in the field of Education. Due to the dominance of lecture based traditional instruction in the Science classes, many students are loosing their interest from Science subject. The present study will be helpful to all those students whose learning styles do not match with their instructors teaching styles. Moreover, it will help to increase students' achievement in Science subject.

The results of the study will inspire all the Science teachers to use these types of Strategies in their routine teaching. It is proved that project base learning using ICT has the potency to cater to diverse needs of learners. Therefore, Science teachers will use more and more projects for instruction. It is proved that integration of technology, particularly multimedia-based technology in classroom teaching helped to cater different learners. Thus, teachers will inspire to use technology for their subject teaching. The role of the teacher will shift from instructor to facilitator. Students will be active partners in the whole teaching-learning process.

These types of strategies can be used for all subjects and for all levels of education. Thereby improved achievement and positive attitude towards the subject. The concept of learning styles should be included in the syllabus of

teacher education. The knowledge of learning styles will help trainee teachers to understand the learners in a better way. The learning styles profile of the students should be kept in mind while designing sessions plan during practice teaching.

Various learning styles inventories are used to determine the learning styles of an individual or group of students. Most of the tools are in English language. The investigator prepared the learning styles inventory (ILS) in local language Gujarati. It will be very useful to local school teacher to identify the learning styles profile of their students. Moreover, Science Attitude Scale (SAS) prepared by the investigator can be utilized to measure students' attitude towards the Science subject.

The study will be helpful to state government during their in-service training programs to realize their quality education goal. Ultimately, it can be helpful to achieve the target of univesalization of quality education.

5.16 CONCLUSION

In the present study, the investigator has designed the instructional strategies catering to the learning styles of students. The strategies were found to be effective with respect to academic achievement of the students. Moreover, attitude of experimental group towards the science subject was found to be significantly favorable than that of the comparison group. Ultimately, it improved students' attitude towards Science subject. Therefore, science teachers must use these types of strategies for their routine teaching.

5.17 SUGGESTIONS FOR FUTURE STUDIES

❖ Research is needed to clarify how much difference it makes if teaching methods are incongruent with students' learning styles. Studies that speak the role and potency of style, seen in conjunction with other important variables, would help teachers significantly. The development of better instrumentation to identify learning styles should be key part of such research.

❖ Research is needed to illuminate the connections and interaction between learning style, developmental stage, disciplinary perspectives, and epistemology. A better understanding of link between them would provide a helpful framework for examining teaching methodologies, the role of learning in individual development and the use of disciplines to promote more complex and integrative thinking.

❖ There is a need to research role of learning styles in language learning, particularly in English language. English is considered as a global language, therefore this type of research would help many students in non- English speaking countries.