Chapter Three

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3.0 INTRODUCTION

This chapter presents details regarding the strategies catering to the learning styles of the students, which were developed and implemented in order to achieve second objective of the study.

3.1 CONCEPT OF STRATEGIES

Initially the term strategy was used in the military. It means "the art of commander in chief". As years went by the term took on other connotations. It gradually developed generic applications. According to oza (1995) "a number of or a combination of learning styles towards the purpose is what are termed as learning strategies". According to Flenders (1970) "strategy is the way which the teacher handles a classroom situation in order to facilitate learning". In short instructional strategies are number of inputs in the form of different methods and media applied to teaching-learning process intended to bridge the gaps between the teaching styles and learning styles.

The investigator designed the strategies by keeping in mind the learning styles profile of the class. Presumably traditional lecture based method caters intuitive, verbal and sequential style of learners but sensing, visual, active, global and some what reflective learners are at far distance in the traditional lecture based method. Therefore, the investigator decided to combine the inputs for these types of learners with traditional lecture based method.

3.2 STRATEGIES CATERING TO THE LEARNING STYLES

Learning styles of most of the students in science and teaching styles of most teachers are incompatible in several dimensions. The inclusion of a relatively small number of techniques in an instructor's repertoire should be sufficient to meet the needs of most or all the students in class. The techniques and suggestions are given bellow.

3.2.1 (a) Teaching Styles Congruent to the Learning Styles

Students have different learning styles. Felder-Silverman model of learning styles has been discussed in the conceptual framework. Richard Felder (1988) in his article "learning and teaching styles in engineering education" suggested following model of teaching style congruent to their learning styles and strategies to match diverse learning styles with teaching styles.

Table: 3.1 Dimensions of Learning and Teaching Styles

No	Preferred Learning Styles	Corresponding Teaching Styles
1	Sensory and Intuitive **PERCEPTION**	Concrete and Abstract **CONTENT**
2	Visual and Verbal **INPUT**	Visual and Verbal **PRESENTATION**
3	Inductive and Deductive **ORGANIZATION**	Inductive and deductive **ORGANIZATION**
4	Active and Reflective **PROCESSING**	Active and Passive **STUDENT PARTICIPATION**
5	Sequential and Global **UNDERSTANDING**	Sequential and Global **PERSPECTIVE**

3.2.1(b) Strategies to Match Diverse Learning Styles with the Teaching Styles

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

- 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.

- 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.

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

- 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.

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

- 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.

- 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.

- 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).

- Applaud creative solutions, even incorrect ones (intuitive/ Global).

- Talk to students about their learning styles, both in advising and in classes. Students are reassured to find their academic difficulties may not all be due to personal inadequacies. Explaining to struggling sensors or active or global learners how they learn most efficiently may be an important step in helping them reshape their learning experiences so that they can be successful (All types of learning styles).

3.2.2 Scope of Matching Learning Styles and Teaching Styles Through Technology

Rathod S.J (2004) in his study "identification of the gaps between the teaching styles and the learning styles and exploring the possibilities of bridging these gaps through technology" suggested following uses of technology to bridge the gaps between teaching and learning styles.

The use of computers in the classroom has been predicted by many, as one of the potential saviors of public education .The computer is an enabling technology that must be combined with specialized software and access to information to become an educational tool. Multimedia can be used to address the needs of a variety of student learners. It is useful to demonstrate the effectiveness in addressing the learning styles typically neglected by traditional teaching methods. Interactive multimedia learning systems with network connectivity are seen as a way of improving individual instruction in the face of growing classrooms and shrinking resources. It is imperative that the learning styles and learning styles models are taken into account for instruction delivery. To help the auditory and visual learners the teacher can use teaching aids like Tape-Recorder, Film Strip, O.H.P, L.C.D Projector etc. To help kinesthetic learner's teacher has to give them computer keyboard and mouse-drag exercises. Use discovery method and project based learning with the integration of ICT for maximum topics, because these methods are useful for all types of learners. Use various computer based educational softwares in routine teaching. Use PowerPoint presentations for teaching of different topics in the Science. Collect pictures and video clips from various resources like web and Microsoft Encarta.

3.3 INTEGRATION OF DESIGINED STRATEGIES IN THE INSTRUCTION

The Investigator decided to incorporate these strategies in daily teaching-learning process in the form of lesson plans. The lesson plans were designed keeping in mind the overall learning styles profile of the class.

3.3.1 Selection of the Content

Science and Technology textbook published by G.S.E.B consists of 15 chapters.

1) Universe

2) Soil

3) Air

4) Cellular Organization

5) Transformation of Matter

6) Metals and Non-Metals

7) Carbon

8) Structure of Atom

9) Refraction of Light

10) Magnetism

11) Electricity

12) Micro Organisms

13) Some Common Diseases

14) Sources of Energy

15) Food production and Food management

In order to select proper chapters from all the chapters, the investigator gave all the lesson titles of Std.VIII, Science and Technology textbook to the students of Std.IX of 2005-06. They were told to rank five most difficult chapters based on

abstractness of the content. The investigator summarized the ranks given by all the students and found out five most common difficult chapters. The following five chapters were selected for the program planning

1) **Universe**

2) **Soil**

3) **Cellular Organization**

4) **Transformation of Matters**

5) **Refraction of Light**

The content analysis was done for all the selected chapters and divided into following sub-units

Table: 3.2 Content Analysis of the Selected Chapters of Science and Technology Textbook of Std. VIII

Unit No	Name of the Unit	Sub-Units
1	Universe	• Celestial Objects • Stars and Variety in their physical properties like colors, masses and brightness • The ever-changing celestial hemisphere • The Solar system • Rotation and revolution of the planets • Moon, Asteroids and Planets • Artificial satellite and it's uses
2	Soil	• Types of soil • Formation of soil • Soil profile

		• Soil constituents • Pollution of soil and control • Erosion of soil and control
3	Cellular- Organization	• Animal cell and Plant cell • Cell structure • Functions of cell organelles • Difference between plant cell and animal cell
4	Transformation of- Matters	• Chemical reactions and energy changes • Methods of purification of substances • Types of chemical reactions
5	Refraction of Light	• Definition of refraction • Some experiments • Refraction of light in glass slab • Laws of refraction • Spectrum

3.3.2 Objectives of the Programme

The investigator using Bloom's Taxonomy of Educational Objectives and Objectives of teaching science at secondary school level framed the following objectives.

Unit-1 **Universe**

- ❖ Students will be able to list out all the members of the solar system.
- ❖ Students will be able to recall physical condition (Color, size, surface) of all the members of solar system.
- ❖ Students will be able to recall atmospheric conditions (Temp, pressure, rain and other factors) of all the members of solar system.
- ❖ Students will be able to list out all the celestial phenomena from the text.

- Students will be able to interpret celestial phenomena from the text.
- Students will be able to interpret the phenomena of rotation and revolution of the objects in the space.
- Students will be able to work in a group.

Unit-2 Soil

- Students will be able to list out types of soil.
- Students will be able to discriminate different types of soil.
- Students will be able to interpret the phenomena of soil formation.
- Students will be able to recall soil profile.
- Students will be able to recall the soil constituents.
- Students will be able to interpret the pollution and erosion of soil.
- Students will be able to perform the experiments related to water holding capacity of different soil and erosion of soil.
- Students will be able to produce the knowledge in the test.

Unit-3 Cellular Organization

- Students will be able to interpret the work of cell as a basic unit of living organisms.
- Students will be able to discriminate the typical plant cell and animal cell.
- Students will be able to draw diagrams of typical plant cell and animal cell.
- Students will be able to list out cell organelles.

- ❖ Students will be able to recall functions of all cell organelles.
- ❖ Students will be able to perform the experiments to check onion cell and cheek cell.
- ❖ Students will be able to produce their knowledge in the test.
- ❖ Students will be able to work in a group.

Unit-4 Transformation of Matter

- ❖ Students will be able to interpret the chemical reactions.
- ❖ Students will be able to form equations based on the chemical reactions.
- ❖ Students will be able to recall the methods of purification of substances.
- ❖ Students will be able to perform the experiment of stem distillation.
- ❖ Students will be able to list out the types of chemical reactions.
- ❖ Students will be able to discriminate the different types of chemical reactions.

Unit-5 Refraction of Light

- ❖ Students will be able to interpret the phenomena of refraction.
- ❖ Students will be able to perform the experiment to study refraction in the glass slab.
- ❖ Students will be able to derive conclusions from the experiment.
- ❖ Students will be able to compare the phenomena of reflection and refraction.

- ❖ Students will be able to interpret the refractive index.
- ❖ Students will be able to interpret the phenomena of rainbow.

It is quite clear that all the above objectives are not possible to be achieved through traditional lecture based instructional method for teaching of Science.

3.4 METHODS AND MEDIA

To address diverse learning styles of the students in the classroom one must use appropriate methods along with media. Project Based Learning (PBL) and Discovery method has potency to address diverse learning styles of the students. For the present study, the investigator used PBL and Discovery methods according to the nature of the content. Other methods like Demonstration, Experimentation were used along with questioning technique. Computer with multimedia softwares, O.H.P, charts, filmstrips and Graphics were widely used in the classroom.

Table 3.3 PROGRAMME PLANNING

Session	Date/time	Learning activities	Assessment	Resources	Evaluation
01/02 **(UNIT-1)**	10/07/2006 8-35 am to 9-45 am	**Movie** A short movie based on the topic will be shown to the students.	Students will prepare list of celestial objects and phenomena shown in the movie	Hollywood movie (Star Wars)	By observing their excitement and their list.

03	11/07/2006 9-10 am to 9-45 am	**Introduction of "Solar System"** Teacher's presentation on the solar system followed by discussion. Teacher will explain the diversity in the color, mass and size of the stars.	Students will prepare a list of all the members of solar system. Short objective type of test.	Picture from NASA website and from Encarta.	Their marks in the test
04	12/07/2006 9-10 am to 9-45 am	**Project work (introduction)** Group formation, assigning the task to the groups.	Asking the question regarding the task clearity.	PBL (John Dewy) and guidelines published by NCSTC of India.	From their answers.
05	13/07/2006 9-10 am to 9-45 am	**Collection of Information** Collection of the information and pictures from different resources like internet, library and Encarta. Compilation of the information.	Observing students work and participation in the groups.	Internet Encarta Textbook	Their participation
06	14/07/2006 9-10 am to 9-45 am	**Preparing Presentations** Preparation of the power point presentation in the computer lab using collected information.	Observing students work and participation in the groups.	Internet, Encarta	Their participation
07	15/07/2006 9-10 am to 9-45 am	**Student's presentation** before the class followed by discussion and question	A test of multiple choice questions. Rating of	Internet, Encarta, Textbook, Library, Newspaper	Their answers on different aspects of presentation.

		answers. Group1 (Sun), Group2 (Mercury), Group3 (Venus).	their presentation.		
08	17/07/2006 9-10 am to 9-45 am	**Student's presentation** before the class followed by discussion and question answers. Group4 (Earth), Group5 (Mars), Group6 (Jupiter)	A test of multiple-choice questions. Rating of their presentation	Internet, Encarta, Textbook, Library, Newspaper	Their answers on different aspects of presentation.
09	18/07/2006 9-10 am to 9-45 am	**Student's presentation** before the class followed by discussion and question answers. Group7 (Saturn), Group8 (Uranus), Group6 (Neptune), Group9 (Pluto).	A test of multiple-choice questions. Rating of their presentation	Internet, Encarta, Textbook, Library, Newspaper	Their answers on different aspects of presentation.
10	19/07/2006 8-35 am to 9-45 am	Group10 (Moon), Summary by teacher	Objective test	Content	Their scores
11	20/07/2006 8-35 am to 9-45 am	**Rotation and Revolution** The teacher will explain rotation and revolution of celestial objects with the help of model. He will discuss **uses of**	Observing their answers Objective type of test	Content Encarta	Their scores in the test Their oral answers

		artificial satellites with the help of PowerPoint presentation			
12 **(UNIT-2)**	21/07/2006 8-35 am to 9-45 am	**Introduction** **-Types of Soil** The teacher will bring different types of soil in the classroom and with the help of students he will find out constituents of the soil and classify it into different types	Oral questions Short multiple choice written test	Samples of different types of soil	From their answers
13	22/07/2006 8-35 am to 9-45 am	**Formation of Soil and Soil Profile** -A short discussion with a geologist on " Formation of Soil and Soil Profile" will be arranged with students	Observing their involvement in the discussion and objective test	Geologist Charts	Their answers
14	24/07/2006 8-35 am to 9-45 am	**Soil Constituents** -the teacher will explain soil constituents with the help of charts followed by discussion	Oral question-answers Multiple choice test	Charts textbook	Their answers
15	25/07/2006 8-35 am to 9-45 am	**Importance of Soil** -The teacher will explain importance of soil with the help of CALM,	Observing their involvement Objective type of test	Computer Aided Learning Material prepared by the teacher using	Their Involvement and answers

		followed by discussion		PowerPoint on "Importance of Soil"	
16	26/07/2006 8-35 am to 9-45 am	**Soil Pollution and Control** A short documentary film based on soil pollution will be shown to the students followed by the discussion on control of soil pollution	Observing their involvement in the film and discussion	Television Multimedia Projector Documentary film Content	Their involvement
17	27/07/2006 8-35 am to 9-45 am	**Erosion of the Soil** - The teacher will clarify erosion of soil with the help of experiments followed by the discussion on control of erosion of soil	Observation of participation of the students during the experiments Objective type of test	Laboratory Textbook Reference books	Their participation Their scores in the test
18 **(UNIT-3)**	28/07/2006 8-35 am to 9-45 am	**Introduction** - the teacher will give computer based PowerPoint presentation discussing " cell as a basic unit of living organism"	Observing their participation Oral questions	Multimedia computer, Encarta, Textbook	Their answers and participation
19	29/07/2006 8-35 am to 9-45 am	**Team Formation and Task assigning** - The teacher will divide class into five teams and assign them task to collect the information and prepare the	Observing their participation in team task	Library	Their involvement

		presentations on animal cell and plant cell			
20	31/07/2006 8-35 am to 9-45 am	**Preparing Presentations** - Students will prepare PowerPoint presentation - Teacher will act as a facilitator	Observing their participation	Computer lab	Their participation
21	1/08/2006 8-35 am to 9-45 am	**Presentations** Team A and B will give their PowerPoint presentations on animal cell followed by discussion	Assessment sheet to assess the presentation	Encarta Internet Textbook	Their scores in the assessment sheet
22	2/08/2006 8-35 am to 9-45 am	**Presentations** Team C, D and E will give their PowerPoint presentations on plant cell followed by discussion	Assessment sheet to assess the presentation	Encarta Internet Textbook	Their scores in the assessment sheet
23	3/08/2006 8-35 am to 9-45 am	**Experiments** -The teacher will perform the experiment to study the onion cell and cheek cell with the help of students	Observation Oral questions Objective test	Laboratory Textbook	Their scores in test
24 **(UNIT-4)**	4/08/2006 8-35 am to 9-45 am	**Introduction** - Through some activities and experiments teacher will define the term "chemical	Oral question-answer Multiple choice objective test	Textbook Laboratory	Scores in the test

		reaction" further he will explain some routine chemical reactions and energy changes during those reactions			
25	5/08/2006 8-35 am to 9-45 am	**Methods of Purification of Substances** - The teacher will demonstrate the experiments related to steam distillation, filtration and crystallization with the help of students followed by discussion	Observing their involvement Objective type of test	Textbook Laboratory	Their participation Marks in the test
26	7/08/2006 8-35 am to 9-45 am	**Types of Chemical Reactions** The teacher will divide class into six teams and tell them to collect the information on assigned type of chemical reactions from the various sources	Observing their activity and participation	Library Internet Encarta	Their participation
27	8/08/2006 8-35 am to 9-45 am	**Team A, B and C will give their presentations with the help of experiments and illustrations** on Precipitation Neutralization Oxidation-	Observing their presentations Assessment sheet	Textbook Laboratory	Their scores in the assessment sheet

		Reduction			
28	9/08/2006 8-35 am to 9-45 am	**Presentations** Team D, E and F will give their presentations with the help of experiments and illustrations on Decomposition, Rearrangement Substitution	Observing their presentations Assessment sheet	Textbook Laboratory	Their scores in the assessment sheet
29 **(UNIT-5)**	10/08/2006 8-35 am to 9-45 am	**Introduction** With the help of different activities and experiments teacher will illustrate the definition and concept of refraction of light followed by discussion	Observing their participation Oral questions Objective test	Textbook Reference books Laboratory	Participation Their scores in the test
30	11/08/2006 8-35 am to 9-45 am	**Refraction of light in the glass slab** - The teacher will divide class into different groups and explain them the experiment of refraction in the glass slab, the students will perform the experiment in the group and derive the laws of refraction	Observing their participation and skills Objective test	Textbook Laboratory	Scores in the test Participation
31	12/08/2006 8-35 am to	**Difference between**	Oral questions	Textbook Reference	Scores of the test

	9-45 am	**reflection and refraction** ***Refractive index*** - The teacher will differentiate phenomena of reflection and refraction through proper illustrations. The teacher will derive the formula to find out refractive index of any substance using different illustrations.	Multiple choice test	book	
32	14/08/2006 8-35 am to 9-45 am	**Refraction of light in the prism and dispersion of light** The teacher will explain dispersion of light using prism performing experiment followed by discussion	Observing their participation Oral questions Objective test	Laboratory Textbook	Their participation Scores in the test
33	16/08/2006 8-35 am to 9-45 am	**Post Test** - 50 marks test based on the content covered in the program	Test paper prepared following guidelines of GSEB	Textbook Guidelines of GSEB	Their scores in the test

3.6 SESSIONS PLANNING

Learning sessions were planned using methodology suggested by Ian Barker (2006) for Cambridge International Diploma. All the session plans are included in the appendix –VI.

3.7 VALIDATING DESIGNED SESSION PLANS

Designed lesson plans were shown to the experts from the field. According to the suggestions given by the experts, necessary modification was done in the session plans. The investigator decided to use lesson plans of one chapter (Universe) for pilot study on students studding in Std.VIII in the year 2005-06. According to the feedback of the investigator made necessary changes and modification in final plans.