CHAPTER IV

METHODOLOGY

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METHODOLOGY

Research methodology is a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically. Methodology occupies a very important place in any type of research as the validity and reliability of the findings depend upon the method adopted for the study. It endears an overview of all the considerations of the research works that is to be executed and at this stage the crucial decisions for the accomplishment of objectives of the study are taken. In short, methodology includes the description of the techniques or methods and tools the researcher has used for collecting, organizing, analyzing and interpreting data. Details of the methodology adopted for the study are presented under the following heads.

4.1 METHOD ADOPTED

Since the intention of the study was to develop strategies based on Animated and Static Visuals for teaching Basic Science, Experimental Method was found to be the best to conduct the study.

Experimentation is the name given to the type of educational research in which the investigator controls the educative factors to which a child or group of children is subjected during the period of inquiry and observes the resulting achievement. As this method provides much control it helps to
establish a systematic and logical association between manipulated factors and observed effects. It is the most sophisticated, exacting and powerful method for discovering and developing an organized body of knowledge.

4.2 DESIGN OF THE STUDY

Experimental design is the blueprint of the procedures that enable the researcher to test hypotheses by reaching at valid conclusions about relationship between independent and dependent variables (Best and Khan, 2011). It provides the researcher an opportunity for comparisons required by the hypotheses of the experiment and enables him to make a meaningful interpretation of the results of the study with the help of statistical analysis of data.

The design selected for the present study was pre-test post-test non-equivalent group design. This design is often used in classroom experiments when experimental and control groups are such naturally assembled groups as intact classes, which may be similar. The design in this study is symbolized as:

\[
\begin{align*}
G_1 & \quad T_1 \quad \ldots \quad X_1 \quad \ldots \quad T_2 \\
G_2 & \quad T_1 \quad \ldots \quad X_2 \quad \ldots \quad T_2 \\
G_3 & \quad T_1 \quad \ldots \quad X_3 \quad \ldots \quad T_2
\end{align*}
\]
Where,

\[ G_1 = \text{Experimental group I (EXP. I)}. \]
\[ G_2 = \text{Experimental group II (EXP. II)}. \]
\[ G_3 = \text{Control group (CON)}. \]
\[ X_1 = \text{Treatment using Animated and Static Visuals based Instructional Strategy}. \]
\[ X_2 = \text{Treatment using Static Visuals based Instructional Strategy}. \]
\[ X_3 = \text{Treatment using Conventional Activity Oriented Method of Teaching}. \]
\[ T_1 = \text{Pre-test}. \]
\[ T_2 = \text{Post-test}. \]

4.3 DIFFERENT STAGES OF THE STUDY

The study is carried out in three stages.

**Stage 1:** The students in all the groups were compared on the basis of their:

a) Previous Achievement in Basic Science.

b) General Mental Ability/Non-Verbal intelligence.

c) Pre-Test Scores.

d) Attitude towards Science.

e) Interest in Science.
Stage 2: This was the treatment stage in which the Experimental Group I was taught using Animated and Static Visuals based Instructional Strategy, the Experimental Group II using Static Visuals based Instructional Strategy, and the Control Group was taught in the Conventional Activity Oriented Method.

Stage 3: After completing the experimental treatment, the students in the Experimental Groups and Control Group were tested on Achievement in Basic Science, Retention of Achievement, Attitude towards Science and Interest in Science.
### TABLE 4.1

**Stages of the Study**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Experimental Group I</th>
<th>Experimental Group II</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Measurement of...</td>
<td>Measurement of...</td>
<td>Measurement of...</td>
</tr>
<tr>
<td>Pre-Test</td>
<td>1. Previous achievement in Basic Science</td>
<td>1. Previous achievement in Basic Science</td>
<td>1. Previous achievement in Basic Science</td>
</tr>
<tr>
<td></td>
<td>3. Initial Knowledge in Basic Science</td>
<td>3. Initial Knowledge in Basic Science</td>
<td>3. Initial Knowledge in Basic Science</td>
</tr>
<tr>
<td></td>
<td>4. Initial Attitude towards Science</td>
<td>4. Initial Attitude towards Science</td>
<td>4. Initial Attitude towards Science</td>
</tr>
<tr>
<td></td>
<td>5. Initial Interest in Science</td>
<td>5. Initial Interest in Science</td>
<td>5. Initial Interest in Science</td>
</tr>
<tr>
<td>Treatment</td>
<td>1. Teaching Basic Science using Animated and Static Visuals based Instructional Strategy</td>
<td>1. Teaching Basic Science using Static Visuals based Instructional Strategy</td>
<td>1. Teaching Basic Science using Conventional Activity Oriented Method</td>
</tr>
<tr>
<td></td>
<td>1. Achievement in Basic Science</td>
<td>1. Achievement in Basic Science</td>
<td>1. Achievement in Basic Science</td>
</tr>
<tr>
<td></td>
<td>4. Delayed Post-test (For Achievement)</td>
<td>4. Delayed Post-test (For Achievement)</td>
<td>4. Delayed Post-test (For Achievement)</td>
</tr>
</tbody>
</table>
4.4 VARIABLES IN THE STUDY

Variables are the conditions or characteristics that the experimenter manipulates, controls or observes (Best & Khan, 2011). In educational research an independent variable may be a particular teaching method, a type of teaching material, a period of exposure to particular condition, a reward, or an attribute such as sex or level of intelligence. The dependent variable may be a test score, the number of errors, or measured speed in performing a task.

**Independent Variables**

The independent variables are the conditions or characteristics that the experimenter manipulates or controls in his attempt to ascertain their relationship to observed phenomena.

In the present study Instructional Strategy is the independent variable. The three strategies are: teaching with a strategy based on Animated and Static Visuals, teaching with a strategy based on Static Visuals and teaching in the Conventional Activity Oriented Method.

**Dependent Variables**

The dependent variables are the conditions or characteristics that appear, disappear or changes as the experimenter introduces, removes or changes independent variable. The major dependent variable of the present study is the Achievement in Basic Science. The other dependent variables
selected are Attitude towards Science, Interest in learning Science and Retention of Achievement in Basic Science.

**Extraneous Variables**

Extraneous variables are those uncontrolled variables that may have a significant influence on the results of a study. The extraneous variables of the present study are the age, socio-economic status, academic ability, intelligence etc. of the students.

**4.5 POPULATION OF THE STUDY**

The population of the study consists of all the students studying in Standard VII in the Upper Primary Schools of Kerala following Kerala state syllabus.

**4.6 SAMPLE SELECTED FOR THE STUDY**

A sample is a small proportion of the population that is selected for observation and analysis and by observing the sample, one can make certain inferences about the characteristics of the population from which it was drawn (Best and Khan, 2011). The random sampling technique was used by the investigator to select the sample.

The sample for the study was selected from M.A.O.U.P. School, Elayur, Malappuram District. The authorities and students were very co-operative and generous to provide ample help at any time to conduct the study. Students in three divisions of standard VII were selected for the study.
After comparing the previous achievement scores, Division A was considered as Experimental Group I, Division B as Experimental Group II and the C Division as Control Group. Even though the initial sample consisted of 168 students, those who were not attended in the pre-test and post-test were removed from the sample selected. Thus the final sample was reduced to 159 students (53 in each group).

### 4.7 TOOLS USED IN THE STUDY

Collection of data is essentially an important part of the research process so that the inferences, hypotheses or generalizations tentatively held may be identified as valid, verified as correct, or rejected as untenable (Koul, 2011). By giving due consideration to the objectives of the study, the investigator prepared various tools. In the present study, the tools used for collecting data are:

1. **Lesson transcripts on Animated and Static Visuals based Instructional Strategy.**
2. **Lesson transcripts on Static Visuals based Instructional Strategy.**
3. **Lesson transcripts on Conventional Activity Oriented Method.**
4. **Achievement test in Basic Science (prepared and standardized by the investigator).**
5. **Science Attitude Scale.**
6. **Science Interest Inventory (prepared and standardized by the investigator).**
4.7.7 Non-verbal Intelligence Test.

4.7.1 Lesson transcripts on Animated and Static Visuals based Instructional Strategy

The investigator prepared lesson transcripts from the contents of Unit I, II and III of Basic Science of standard VII. These units are ‘Pachayam Virippu’, ‘Nam Samrakhshikenda Jalam’ and ‘Thapam Pravarthikkumpol’. These three units were divided into 15 lessons in total. The sample lesson transcripts based on Animated and Static visuals were prepared and it was given to experts in the field of teaching Science and Education. The draft lesson transcripts were modified based on the feedback and comments received from the experts. Then two lesson transcripts of each type were taught by the investigator as try-out in classes of standard VII students. Then the lesson transcripts were again modified and corrected on the basis of actual experience of the investigator. The Malayalam and English versions of Model Lesson transcripts are given as Appendix I & II.

4.7.1.1 Organization of Lesson Transcripts in Animated and Static Visuals based Instructional Strategy

In Animated and Static Visuals based Instructional Strategy each teaching unit is divided into lessons of 45 minutes duration. Each lesson focus on a main idea of the unit and is progressing through the following six phases:
(i) Orientation
(ii) Elicitation
(iii) Presentation of Animation
(iv) Reorientation
(v) Presentation of Static Visuals
(vi) Evaluation

The phases are schematically represented in the following figure:

Figure 4.1 Schematic representation of the progress of lessons in Animated and Static Visuals based Instructional Strategy.
The first stage of any learning process is to receive stimuli through sensory organs. A set of such stimuli works as a raw data for processing. These obtained data is stored in the brain for further processing, as and when required.

**Phase I Orientation**

Each lesson in Animated and Static Visuals based Instructional Strategy starts with the learner’s initial confrontation with the task. Here the teacher provides an introductory orientation for the lesson.

**Phase II Elicitation**

In the elicitation phase, opportunities are provided for pupils to explore and explain their ideas.

**Phase III Presentation of Animation**

This phase is for exhibiting the Animation programme. Teacher presents the programme with the aid of LCD Projector and pupils watch the programme.

**Phase IV Reorientation**

Fourth phase is the reorientation phase and here the restructuring of ideas occurs.
Phase V Presentation of Static Visuals

As the fifth phase, teacher presents the Static Visuals to clarify the ideas in the lesson. Pupils observe the visuals and the ideas are concretized.

Phase VI Evaluation

Evaluation is the last phase in the progress of the lesson and it is used for strengthening the cognitive organization and it leads to the modification of behaviour of the pupils.

Prior to the preparation of animation programmes, the investigator in consultation with the supervising teacher prepared a project outline. After needed theoretical modifications, the investigator consulted specialists in computer graphics to know about the technical aspects of animation. Then prepared an outline of the content based on the first three units included in the Basic Science text book of standard VII.

4.7.1.2 Steps in the Development of Animated and Static Visuals based Instructional Strategy

(i) Preparation of draft scripts for Animation
(ii) Writing two column scripts for Animation
(iii) Developing Story Board for Animation
(iv) Preparation of Animated Visuals
(v) Editing, Dubbing, Music effects and Narration
(vi) Preparation of Static Visuals

(i) Preparation of draft scripts for Animation

In this step the investigator prepared a brief outline about the topics based on the selected objectives. Each unit was divided into different major concepts. Script is considered as the software of any video programme. It is defined as the producer’s version of words of play or scenes and words of film. The depth of the script determines the quality of the programme.

(ii) Writing two column scripts for Animation

In animation terminology, the simple facts are known as ‘ideas’. The rough scripts were analyzed by the investigator and converted it into ideas. Based on these ideas a two column script was prepared. The first column was used to tell about the scene and the second column about the character and dialogues. This two column script was the base of working script. A sample two column Script is presented below:
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Scene</th>
<th>Character &amp; Dialogues</th>
</tr>
</thead>
</table>
| 1.     | A large ground. Laundrymen spread washed dresses to dry. Amminiamma is folding the dried dresses. Suddenly a crying little girl, named Bissy entered the scene. | Ammini: Why are you crying?  
Bissy: My uniform is wet. I haven’t another pair. How I go to school without wearing uniform? My teacher will scold me.  
Ammini: Don’t worry. I shall make it ready. Come on, we can go to the hill where the wind is strong. |
| 2.     | Amminiamma and Bissy hold the dress in wind.  
Scene: when wind blows, water vapour is removed from the cloth and is taken away by wind and less humid air from nearby areas is coming to the vicinity of the wet cloth. | Ammini: If we hold the dress like this, the wind will drink the water from the cloth soon.  
Bissy: Yes, Yes.. the process is called evaporation. Water molecules are taken away from the wet cloth as vapour.  
Ammini: So the water vapour from the cloth enter to the surrounding air.  
Bissy: Hai Amminiamma, My uniform is now well dried. In which school you have studied this technique?  
Ammini: My grandmother told me this; the story of ‘water drinking’ by wind. |
| 3.     | Amminiamma folded Bissy’s uniform and gave it to her. Both went back to the ground. |                                                                                       |
(iii) Developing Story Board for Animation

It is the working script for the production of animation. It contains a detailed view of number of drawings per scene, timing of frames, dialogues to deliver, special effects and sequence of presenting characters. The story board helps the animator to develop the programme in accordance with the preplanned requirements. The English version of all the Story Boards prepared by the investigator for the lessons are presented in the next pages.
STORY BOARDS
(ENGLISH VERSION)
BASED ON STANDARD VII BASIC SCIENCE TEXT BOOK

UNIT I- PACHAYAM VIRIPPU
1. Pacha thanne pacha
2. Budding Maman
3. Dasanum Vijayanum
4. Sankarayinam Vithukal

UNIT II- NAM SAMRAKSHIKKENDA JALAM
5. Urul Pottal
6. Mazhaveedu
7. Jalachakram
8. Gulfasayam
9. Sudhajalam Dhanyajalam
10. Ashaya Vaividhyam

UNIT III- THAPAM PRAVARTHIKKUMPOL
11. Kattu Vellam Kudikkumpol
12. Oru Veyiletta Athumathi
13. Ariyo? Avilo?
14. Change Super Change
15. Enthu Sukhamanee Kattu
### STORY BOARD 1

**PACHATHANNE PACHA**

<table>
<thead>
<tr>
<th>Idea</th>
<th>Background</th>
<th>Visuals</th>
<th>Music</th>
<th>Characters and Dialogue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological Nitrogen Fixation</td>
<td>Silent atmosphere. Near the expansive paddy field two houses, one roofed with tiles and the other built with concrete. Head of the families, Vimalakshan and Govindankutty, looked worried. Their children Vidya and Nithya are coming back from the playground.</td>
<td><img src="image1.png" alt="Vimalakshan and Govindankutty" /></td>
<td>Background music</td>
<td>Vidya: Father, why are you looking grief?</td>
</tr>
<tr>
<td>Patting on her father’s shoulder</td>
<td></td>
<td><img src="image2.png" alt="Vidya patting her father's shoulder" /></td>
<td></td>
<td>Vimal: All our farming is in big loss. What can we do?</td>
</tr>
<tr>
<td>Pointing to the paddy field</td>
<td></td>
<td><img src="image3.png" alt="Vimal and Govindankutty pointing to the paddy field" /></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Both Vimalakshan and Govindankutty put their hands on head | Wind blows strongly | Nithya: Vidya, how can we solve this problem?  
Vidya: Yes, there is a way!  
Nithya: Where? Where? |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pointing to the pea hanging orchard</td>
<td>Natural sound</td>
<td>Vidya: There….</td>
</tr>
</tbody>
</table>
| Children ran to the orchard by singing and dancing. Vidya with a smile | Background music | Vidya: Nithya… Rhizobium Rhizo……… Rhizo…..  
Vidya: Bactor… Bactor…. Azetobactor..  
Nithya: Bactor… Bactor….?  
Vidya: Rhi…..Rhi…. Rhizobium. |
<p>| Nithya looked at Vidya without understanding what she said. | | |</p>
<table>
<thead>
<tr>
<th>Methodology 133</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Children sing and dance around the orchard. Both Vimalakshan and Govindankutty hide their ears to avoid the loud voice. Shouting</strong></td>
</tr>
<tr>
<td><strong>Back-ground music</strong></td>
</tr>
<tr>
<td><strong>Vimal:</strong> Your Rhizobacter…….. …we are thinking of our existence.</td>
</tr>
<tr>
<td><strong>Govi:</strong> Stop please…..</td>
</tr>
<tr>
<td><strong>Vidya:</strong> Oh God..Rhizobacter?</td>
</tr>
<tr>
<td><strong>Vidya:</strong> Rhizobium…..</td>
</tr>
<tr>
<td><strong>Nithya:</strong> Azetobacter…</td>
</tr>
</tbody>
</table>
Uproot a pea plant and pointing to the roots

Vidya: Father, Rhizobium is a bacteria found in the roots of pea plants. Azetobacter is found in the soil.

Vidya: This particular bacteria can convert atmospheric nitrogen to nitrates.

Nithya: What the pea plants do with this nitrates?

Vidya: They store it in their roots.

Vimal: Is all the nodules in root contain nitrates?

Vidya: Offcourse.
Two bacteria come out from the root nodules and absorbs nitrogen. It accumulates in the roots.

<table>
<thead>
<tr>
<th>Govi: Hi.. very interesting.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vimal: They convert nitrogen to nitrates in a great speed.</td>
</tr>
</tbody>
</table>

| Vidya: Why do you spend too much money to buy manures? |
| Vimal: It is right. If we plant pea we will get double gain! |

| Govi: No need to spend money for manures! |
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<table>
<thead>
<tr>
<th>Idea</th>
<th>Background</th>
<th>Visuals</th>
<th>Music</th>
<th>Characters and Dialogue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modern agricultural practices-Budding</td>
<td>Sound of delighted children coming by howling boisterously. The sound rising up from the hillside. Budding uncle is also there with his ornamented</td>
<td>Back-ground music</td>
<td>Children: Oho..Oho..Oho.. Hi.. Aaha…Aaha..Ah ..ha..ha</td>
<td></td>
</tr>
<tr>
<td>Budding Sound of delighted</td>
<td>Back-ground music</td>
<td>Budding uncle came..our Budding uncle came..</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methodology</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>137</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **arched pole.**
  - Buds of a variety of plants are hanged on it.
  - Children walking behind him by singing a song.

- **Came…Came… Budding uncle came…**

- **Budding uncle and children reached under a tree at the top of the hill.**
  - Children running around the tree singing and dancing.

- **Background music**
  - **Children:** Hai..Buddy..our..Buddy Buddy…Buddy..sweet Buddy

- **Stopping the dance.**
  - Children lifted plants with differently coloured flowers.

- **Buddy:** Have you all seen the wonder plant?
  - **Children:** Yes,Yes…!

- **Children walking around the tree singing and dancing.**

  - **Children:** Hai..Buddy..our..Buddy Buddy…Buddy..sweet Buddy..sweet Buddy
<p>| Hearing the cry of a little child. Children moved to make him way. A small child, named Appu, entered the scene with a twig of rose plant. | Background music | Appu: Oh God I haven’t got. I also need that wonder plant. Buddy: Don’t cry Appu..We can make the wonderplant. |
| Buddy by showing his ornamented arched pole | | Buddy: This is budding arched pole. This have the buds of rose plants having differently coloured flowers. Look..this is rose coloured…..this is yellow coloured… Children: Hai..very beautiful! Buddy: Look , yellow and white flowers in the same stem. Appu: Hai…how it happened? Buddy: Yes, I shall explain Appu. What colour of flower is found in your plant? |</p>
<table>
<thead>
<tr>
<th>Buddy make a ‘T’ shaped incision on the stem of Appu’s rose. Inserting the bud of red rose plant there and tied it with a plastic tape.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appu watered the plant. A parrot sings.</td>
</tr>
<tr>
<td>The sun rises. Children sing.</td>
</tr>
<tr>
<td>Sound of parrot</td>
</tr>
<tr>
<td>Children: Hai..Buddy..our.. Buddy Buddy…Buddy.. sweet Buddy.</td>
</tr>
<tr>
<td>Firstly white rose flowers and then red rose flowers appear. Buddy gives the plant to Appu and returning with his ornamented arched pole. Children also followed him by singing and dancing.</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Children: Hai..Buddy..our.. Buddy Buddy…Buddy.. sweet Buddy.</td>
</tr>
</tbody>
</table>
## STORY BOARD 3
**DASANUM VIJAYANUM**

<table>
<thead>
<tr>
<th>Idea</th>
<th>Background</th>
<th>Visuals</th>
<th>Music</th>
<th>Characters and Dialogue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modern agricultural practices-Layering.</td>
<td>Dasan and Vijayan are classmates. Vijayan is sleeping under a guava tree. Dasan is sitting on the branches of that tree. A guava fruit falls on the head of Vijayan. He woke up shockly.</td>
<td><img src="image1.png" alt="Image" /> <img src="image2.png" alt="Image" /> <img src="image3.png" alt="Image" /> <img src="image4.png" alt="Image" /> <img src="image5.png" alt="Image" /></td>
<td>Back-ground music</td>
<td></td>
</tr>
<tr>
<td>Loudly</td>
<td>Dasan not caring.</td>
<td><img src="image6.png" alt="Image" /> <img src="image7.png" alt="Image" /> <img src="image8.png" alt="Image" /></td>
<td></td>
<td>Vija: Dasa.... what are you doing there?</td>
</tr>
<tr>
<td></td>
<td>Again not pay attention to ,but smiling</td>
<td><img src="image9.png" alt="Image" /> <img src="image10.png" alt="Image" /> <img src="image11.png" alt="Image" /></td>
<td></td>
<td>Vija: Dasa.. are you deaf?</td>
</tr>
<tr>
<td></td>
<td></td>
<td><img src="image12.png" alt="Image" /> <img src="image13.png" alt="Image" /> <img src="image14.png" alt="Image" /></td>
<td></td>
<td>Vija: Hey fool, what are you doing there?</td>
</tr>
</tbody>
</table>
Dasan trying to cover an injured branch of guava tree with a mixture containing soil.

Demonstrating air layering on the guava twig.

Vija: What are you planting on the guava tree?

Das: I am producing good quality guava sapling.

Vija: Hey fool, all are planting trees in soil.

Das: I have no land, but this guava alone. This is good quality guava. It is very difficult to sprout its twig. I shall make good quality saplings from this twigs and sell it for good price.
Vija: Oh..this Dasan is mad...he is mad.. Oh.. come on friends …come hurry…

Vijayan ran to his friends and came with them . Budding uncle is also with them. All children together sing a song ridiculing Dasan.

<table>
<thead>
<tr>
<th>Background music</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dasa ..Dasa.. foolish Dasa… Guava fruit eating Dasan….. Nameless guava ..fool’s food guava…</td>
</tr>
</tbody>
</table>

Buddy: Stop please.. Dasan is my student. I have taught him the technique of layering. In this technique , we make a small break on the twig of a plant and
Buddy demonstrates the technique.

cover that part with mixture of wet soil.

Buddy: We can perform layering, also in Sapota, Manjifera etc.

All wondered. Vijayan opened his mouth in astonishment.

Dasan hugged Vijayan. Dasan put a big guava fruit in Vijayan’s mouth.

Children sing together.

Das: Vijaya...
Vija: Dasa....
Dasan : Have this round guava fruit..
Children: Lay….Lay….Layering.
Layering.
**Methodology**

<table>
<thead>
<tr>
<th>Idea</th>
<th>Background</th>
<th>Visuals</th>
<th>Music</th>
<th>Characters and Dialogue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hybridization and hybrid varieties</td>
<td>Balu and his mother are in vegetable market. Long peas are hanging in the air. Big tomatoes and long brinjal are displayed in trays.</td>
<td><img src="image" alt="Visual" /></td>
<td>Background music</td>
<td>Balu: Mom, Is these vegetables are imported?</td>
</tr>
</tbody>
</table>

**STORY BOARD 4**

**SANKARAYINAM VITHUKAL**

<table>
<thead>
<tr>
<th>Scratching on his head</th>
<th>Dasan: Do you know who is the real fool now?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vija: Dasa… sorry. I called you fool.</td>
<td>Buddy: He is not a fool.</td>
</tr>
<tr>
<td>Buddy: He is layering Dasan.</td>
<td></td>
</tr>
</tbody>
</table>
Mother: These are hybrid peas.

Balu: Then, what about this?

Mother: This is native pea.

Balu: How the hybrid peas are made?

Mother: Pea plants belong to the same species and having different qualities can be crossed to get new plants having qualities of both.
| Scene: Artificial pollination | Background music | Balu: So these are called hybrid varieties.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother: This pea is produced by planting improved hybrid seeds.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balu: Then, what about this apple?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother: This is not apple. It is hybrid tomato.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother shows the hybrid and native items separately.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The shopkeeper is handing over the bag carrying vegetables to Balu’s mother.  

**STORY BOARD 5**

**URUL POTTAL**

<table>
<thead>
<tr>
<th>Idea</th>
<th>Background</th>
<th>Visuals</th>
<th>Music</th>
<th>Characters and Dialogue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land slide-causes and remedies.</td>
<td>Tintu and Sonia are flying in large balloons over the hill. Pointing to the stored rain water on the hill top.</td>
<td><img src="image1" alt="Visual" /> <img src="image2" alt="Visual" /> <img src="image3" alt="Visual" /> <img src="image4" alt="Visual" /> <img src="image5" alt="Visual" /></td>
<td>Background music</td>
<td>Tintu: Soni… look. There is a large lake.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Soni: That is not a lake. There was heavy rain in the night yesterday. The rain water get accumulated there.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Tintu: Hai… let us bath in that water.</td>
</tr>
</tbody>
</table>
Frightened


Sound of thunder

Background music

Soni: Oh Tintu, what foolishness you are talking?

Tintu: What?

Soni: This area is very steep and having no trees. Therefore, this lake may rush down anytime.

Tintu: Oh…

Soni: Do you read in newspaper that landslide is the process of sudden rush down of water, soil and stone from the hills?

Tintu: There is not even a single tree!

Soni: Yes, deforestation is an important cause of landslide. When water is stored above the storage capacity of soil, the top soil will become wet and weak.
Tintu: Is there any rock under the soil?

Soni: Yes, but here the bond between rock and soil is lost. Moreover, deep inclination is here.

Tintu: Oh God…Soni …are you telling that land slide occur here? Can we prevent it?

Soni: We can prevent land slide by planting trees, and making arrangements to allow water to ooze out immediately.

Tintu: Soni…Shall we get down?

Soni: That area might be destroyed….  

Chorus: All is gone…..
### Methodology

<table>
<thead>
<tr>
<th>Idea</th>
<th>Background</th>
<th>Visuals</th>
<th>Music</th>
<th>Characters and Dialogue</th>
</tr>
</thead>
</table>
| Storage of rain water.             | Balu and Santha are standing in the verandah with their mother, by enjoying rain. Pointing to the arrangements near the well, to store up rain water. | ![Visual](image1.png) ![Visual](image2.png) ![Visual](image3.png) ![Visual](image4.png) | Back-ground music | Balu: Mom, that small house near our well belongs to whom?  
Mother: That is the rain house. |
Santha: Rain house? What is that?
Mother: I will show you.

All go outside by unfolding the umbrella. Pointing to the house roof

Mother: Look there… All the rain water that falls on the roof is collecting inside the Rain house, through a pipe.

Balu: Do we drink this water?

Mother: Even after the rainy season we get enough pure water from this Rain house.
Santha: Mom, this functions as a rain bank.

Mother: Of course. The overflowing water from the tank is running
| Music from outside. Balu’s father and the members of rain water harvest team enters. | Background music | Father: Is our rain water collection tank full?  
Mother: Our children call it Rain house / Rain bank.  
Balu: Am I right? Father deposits money in the bank. We deposit rain water in the rain bank.  
Father: Many a mickle makes a muckle.  
All together: Many a mickle makes a muckle. |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>down the soil and get collected in the well.</td>
<td></td>
</tr>
<tr>
<td>All laugh</td>
<td></td>
</tr>
</tbody>
</table>
## STORY BOARD 7
### JALA CHAKRAM

<table>
<thead>
<tr>
<th>Idea</th>
<th>Background</th>
<th>Visuals</th>
<th>Music</th>
<th>Characters and Dialogue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generating energy through water wheel.</td>
<td>Damu is going out for playing, by taking a long and a short stick in his hand.</td>
<td><img src="visual1.png" alt="Visual" /></td>
<td></td>
<td>Damu: Mom, I am going outside to play.</td>
</tr>
<tr>
<td>Sound from inside</td>
<td></td>
<td><img src="visual2.png" alt="Visual" /></td>
<td></td>
<td>Mother: You should return before the rain comes.</td>
</tr>
<tr>
<td>Damu runs to the ground. Suddenly wind blows, thundering and heavy rain. Damu ran into the big hollow of a tree, near the ground. He kept his sticks outside. They looked like ‘+’. Lightning and thunder.</td>
<td><img src="visual3.png" alt="Visual" /></td>
<td><img src="music.png" alt="Back-ground music" /></td>
<td><img src="music.png" alt="Back-ground music" /></td>
<td>Damu: What a ruinous rain?</td>
</tr>
</tbody>
</table>
Rain stops. Damu is drowse. His drowse face.

Tic…tic.. He wake up at the sound. Rain drops hitting on the sticks. Damu is looking with curiosity. He is smiling and thinking in a dreamy mood.

With his sister Leela

Damu put small sticks across each other and now it looks like a wheel. He fixed the wheel with nails to a two legged stand.

Background music

Leela: Months ago you have promised me to make a water wheel for me.

Damu: You look…! I will make it now.

Leela: Brother, here is hammer and nails.
<table>
<thead>
<tr>
<th>Methodology</th>
<th>Leela helping him. Now the wheel can rotate on its axis.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Leela pours water to the wheel from a pot. The wheel rotates. Both laughs.</td>
</tr>
<tr>
<td></td>
<td>Leela poured the remaining water to Damu’s head. Damu woke up from the dream. Looks around. He took his sticks and ran away to home.</td>
</tr>
<tr>
<td>Background music</td>
<td></td>
</tr>
<tr>
<td>Damu: Leela….. Leela…. I understood….I understood….! Water wheel….. Water wheel…!</td>
<td></td>
</tr>
</tbody>
</table>
# STORY BOARD 8

## GULFASAYAM

<table>
<thead>
<tr>
<th>Idea</th>
<th>Background</th>
<th>Visuals</th>
<th>Music</th>
<th>Characters and Dialogue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Techniques to purify sea water-distillation.</td>
<td>Balu and Bissy are standing on the road side. They are waiting for the school bus.</td>
<td>![Visual 1]</td>
<td>Background music</td>
<td>Balu: Bissi, within five minutes the bus will come. Bissi: Right, where is our ‘gulfasayam’. Balu: ‘Gulfasayam’? Who is that? I have heard of ‘Amasayam’. But… Bissi: Hi..our Basheer. Balu: Is it Basheer? His father has returned from Gulf just on the day before yesterday. How soon he has got a...</td>
</tr>
<tr>
<td>Looking to the watch.</td>
<td>![Visual 2]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>![Visual 3]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Methodology

<table>
<thead>
<tr>
<th>Balu saying in a low voice.</th>
<th>Background music</th>
<th>Balu saying in a low voice.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bissi: We have got a bottle of mineral water from his bag. Do you remember it? That is ‘Gulfasayam’.</td>
<td>Basheer is coming. He raised the hat from his head and waved it in a happy mood.</td>
<td>Balu: Yes, he is coming.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Balu: Basheer, where is your ‘gulfasayam’?</td>
</tr>
<tr>
<td></td>
<td>Basheer: Hello…Hai…’Gulfasayam’</td>
<td>Basheer is coming. He raised the hat from his head and waved it in a happy mood.</td>
</tr>
<tr>
<td>Basheer taking the bottle from his bag and raised it in the hand.</td>
<td>Basheer: ‘Gulfasayam’? What?</td>
<td>Bissi: Yes, water bottle...drinking water of Gulf. …’Gulfasayam’.</td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td>Basheer raising the collar of his shirt in pride.</td>
<td>Basheer: Son ... Dinesh. This is an important thing everywhere in the world.</td>
<td>Balu: What is that?</td>
</tr>
<tr>
<td></td>
<td>Basheer: Yes, you have named the bottled drinking water of Gulf as ‘gulfasayam’.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bissi: Gulf is in desert. Then, how we get water from there? Basheer: Simple... In Gulf sea water is purified through distillation and then bottled.</td>
<td>Balu: What is distillation?</td>
</tr>
</tbody>
</table>
Basheer is taking out some pictures from his bag. Pictures illustrates different steps of distillation.

Basheer taking out the water bottle and giving it to Balu and Bissi. They drink it.

**Basheer:** It is the process of purifying salty sea water to drinking water. Have you got the idea?

**Basheer:** My father has given me the pictures describing distillation.

**Bsheeer:** Hello.. how is it?

**Balu & Bissi:** Fine..! Fine..! ‘Gulfasayam’.
## STORY BOARD 9
### SUDHAJALAM DHANYAJALAM

<table>
<thead>
<tr>
<th>Idea</th>
<th>Background</th>
<th>Visuals</th>
<th>Music</th>
<th>Characters and Dialogue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Techniques to purify water.</td>
<td>Balu and Bissy are getting down from the school bus. Balu waved his hands to Bissy and ran to his house. He throws his bag and umbrella to verandah and opens the tap in the country yard, to drink water.</td>
<td>![Visual1]</td>
<td>Background music</td>
<td>Mother: Balu come here. Don’t drink it.</td>
</tr>
<tr>
<td>Sound from inside.</td>
<td></td>
<td>![Visual2]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balu raised his face and stood in wonder. Mother opened the door and came to outside and twisted the ear of Balu with</td>
<td>![Visual3]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Her fingers.</td>
<td>Mother: Don’t drink pipe water, I have told you several times.</td>
<td></td>
<td></td>
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<tr>
<td>-------------</td>
<td>---------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Balu: Oh...this water is from our own tap.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mother: Yes, but we should assure that the water we drink is always pure.</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

| Mother poured clean water from a jug to a glass. | Mother: Um..drink this. I have collected it from our well and stored in our kitchen. |

<table>
<thead>
<tr>
<th>Balu drinks water</th>
<th>Background music</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Balu: Hai this has the same taste of Basheer’s ‘gulfasayam’.</td>
</tr>
<tr>
<td></td>
<td>Mother: What? Gulfasayam? Balu: Basheer’s father brought bottled water from Gulf and</td>
</tr>
</tbody>
</table>
we named it as ‘gulfasayam’.

Mother: Yes
Balu, that is purified water.

Balu: Mom, how can we differentiate between pure and dirty water?

Mother taking pipe water in one glass and well water in other.

Mother: Look here. Well water looks crystal clear. But pipe water is somewhat faded in appearance. Do you see it?
Balu: Yes.

Mother: This faded water have low quality. But pure water lacks bad odour and bad taste.
Balu: So, I have tried to drink impure water?

Mother: Yes.
Mother takes out a bottle from Balu’s bag.

She poured well water to it

Balu nods his head happily.

**STORY BOARD 10**

**ASAYA VAVIDHYAM**

<table>
<thead>
<tr>
<th>Idea</th>
<th>Background</th>
<th>Visuals</th>
<th>Music</th>
<th>Characters and Dialogue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purification of water using Aluminium alum/ Pottash alum</td>
<td>Balu and his mother are in verandah. Bissy and Basheer running towards them and entering to verandah.</td>
<td>Back-ground music</td>
<td>Basheer: Are you coming to play with us?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Balu: Yes. Basheer, have you taken ‘gulfasayam’?</td>
</tr>
<tr>
<td>Showing the bottle filled with well water.</td>
<td>Mother: Balu, Basheer has taken it for drinking after play. Balu: Mom, you have given me ‘kinarasayam’ to drink.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother collects water from the tap.</td>
<td>Bissy: Aunt, Basheer has got ‘gulfasayam’, Balu has got ‘kinarasayam’. But I have got nothing.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bissy in grief</td>
<td>Mother: Don’t worry. We can purify this pipe water. We can keep it sometime to settle down the dust particles. We can also add some Aluminium alum in it.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
When put Aluminium alum, small dust particles joined together. Mother removed the sediment.

<table>
<thead>
<tr>
<th>When put Aluminium alum, small dust particles joined together. Mother removed the sediment.</th>
<th>Back-ground music</th>
<th>Mother: This type of purification is called coagulation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother transferred the purified water to a bottle Balu and Basheer writing and pasting some labels on all the bottles.</td>
<td>Back-ground music</td>
<td></td>
</tr>
</tbody>
</table>
Read

Bissy: ‘Pypasayam’

Mother: ‘Gulfasayam to Basheer, ‘kinarasayam’ to Balu and ‘pypasayam’ to Bissy.

All laughs.....
Children raising their bottles.
Gulfasayam Kinarasayam Pypasayam.

Back-ground music

TORY BOARD 11
KATTU VELLAM KUDIKKUMPOL

<table>
<thead>
<tr>
<th>Idea</th>
<th>Background</th>
<th>Visuals</th>
<th>Music</th>
<th>Characters and Dialogue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaporation</td>
<td>A large ground. Laundrymen spread washed dresses to dry. Amminiamma is folding the dried dresses. Suddenly a crying little girl, named Bissy entered the</td>
<td><img src="image1.jpg" alt="Visual" /></td>
<td>Back-ground music</td>
<td></td>
</tr>
</tbody>
</table>
Ammini: Why are you crying?

Bissy: My uniform is wet. I haven’t another pair. How I go to school without wearing uniform? My teacher will scold me.

Ammini: Don’t worry. I shall make it ready. Come on, we can go to the hill where the wind is strong.

Amminiamma and Bissy hold the dress in wind.

Ammini: If we hold the dress
<table>
<thead>
<tr>
<th>Scene: when wind blows, water vapour is removed from the cloth and is taken away by wind and less humid air from nearby areas will come to the vicinity of the wet cloth.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bissy: Yes, Yes.. the process is called evaporation. Water molecules are taken away from the wet cloth as vapour</td>
</tr>
</tbody>
</table>

| Ammini: So the water vapour from the cloth enter to the surrounding air. |

| Bissy: Hai Ammin iamma, My uniform is now well dried. In which school you have studied this technique? |

| Ammini: My grandmother told me this; the story of ‘water
<table>
<thead>
<tr>
<th>Amminiamma folded Bissy’s uniform and gave it to her.</th>
<th>Background music</th>
<th>drinking’ by wind.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Both went back to the ground.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td>Bissy: Look! There is sunshine in the valley.</td>
<td></td>
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</tbody>
</table>
### STORY BOARD 12
### ORU VEYILETTAL ATHUMATHI

<table>
<thead>
<tr>
<th>Idea</th>
<th>Background</th>
<th>Visuals</th>
<th>Music</th>
<th>Characters and Dialogue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evapo-ration</td>
<td>Scene: Ammini-amma’s laundry and ground. She is spreading out the wet clothes, with the help of Bissy, on the clothes-line.</td>
<td><img src="image1" alt="Visuals" /></td>
<td>Background music</td>
<td>Ammini: Oh.. you helped me a lot. Otherwise I have broken my waist. Bissy: Oh …Amminiamma …it is O.K.</td>
</tr>
<tr>
<td></td>
<td>Ammini patted on Bissy’s head in great affection. Sunshine is becoming intense. Ammini hided her eyes with hand to look at the sun. Due to heavy heat the tightly stretched</td>
<td><img src="image2" alt="Visuals" /></td>
<td>Back-ground music</td>
<td></td>
</tr>
<tr>
<td>Methodology</td>
<td>172</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

| clothes-lines are becoming loose and clothes are touching the ground. |
| --- | --- |
| Ammini: Look daughter…. When heat increases a ghost will come and touch the clothes in ground to make it dirty. The ghost is very interested in doing so! I am taking too much effort to clean these dresses! |

<p>| Bissy closely observes the clothes-line. |
| --- | --- |
| Ammini-amma looking to Bissy. |
| Background music |
| Bissy: Ammini-amma… look here.. |
| Ammini: What is there? |
| Bissy: All your clothes-lines are made with metal. |
| Ammini: So what? |
| Bissy: Do you have tightly stretched all the metal –wires? |
| Ammini: Ofcourse, I have tightly stretched it this morning. |</p>
<table>
<thead>
<tr>
<th>Methodology</th>
<th>173</th>
</tr>
</thead>
</table>

| Both together removed the clothes from the metal-wire. Now it is having bends. Ammini in wonder. | Back-ground music | Bissy: Now look.. |

| Showing the clothes touching the ground. |  | Bissy: When heat increases the iron wires expands and its length increases. So the wires bend towards the ground. |

| Taking dried dress in hand, Bissy is going. |  | Ammini: Isn’t ghost did this? Oh.. you have saved me, daughter. I have broken my waist by cleaning the dresses again and again. |

<p>| Ammini is looking at Bissy. |  | Bissy: I have to buy rice and beaten rice from the market. Mom and Balu may be waiting for me at home. |</p>
<table>
<thead>
<tr>
<th>Idea</th>
<th>Background</th>
<th>Visuals</th>
<th>Music</th>
<th>Characters and Dialogue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of a thing is not depending on its size but depends on the number of molecules it contains.</td>
<td>Balu and mother are waiting for Bissy.</td>
<td></td>
<td>Back-ground music</td>
<td>Balu: Mom, look... Bissy is coming.</td>
</tr>
<tr>
<td>By seeing the two packets in Bissy’s hand, Balu laughs.</td>
<td></td>
<td></td>
<td>Back-ground music</td>
<td>Balu: Mom, I have told you earlier that I shall go to the market.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mother: What? What happened?</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bissy: When I went to collect my clothes from the laundry, your mother told me to buy rice and beaten rice from the market.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Balu: Mom, did you told her to buy 500g rice and 500g beaten rice? Isn’t it?</td>
</tr>
<tr>
<td>Methodology</td>
<td>175</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Lifting both the packets</th>
<th>Background music</th>
<th>Balu: This is the packet of rice. Is 500g beaten rice weighs more than 500g rice?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balu ridiculed Bissy. She is crying. Both of them quarrel.</td>
<td></td>
<td>Balu: You are mistaken.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bissy: You are a fool.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Balu: You foolish.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mother: Stop it…Stop it… You need not quarrel about this issue. We can examine who is mistaken.</td>
</tr>
<tr>
<td>Mother comes with a balance and 500g weight. Putting weight in one pan of the balance and putting the rice packet on the other.</td>
<td></td>
<td>Mother: Look here…. This is 500g weight.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mother: Give me the packet of rice.</td>
</tr>
<tr>
<td>Methodology</td>
<td>176</td>
<td></td>
</tr>
<tr>
<td>-------------</td>
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<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mother replaced rice with beaten rice. Balu looks at Bissy. Balance weighs both packets as 500g.</th>
<th><img src="image1.png" alt="Image" /></th>
<th>Mother: Now give the packet of beaten rice.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balu taking the packets in hand and examines.</td>
<td><img src="image2.png" alt="Image" /></td>
<td>Mother: Now tell me which packet is heavier?</td>
</tr>
<tr>
<td></td>
<td><img src="image3.png" alt="Image" /></td>
<td>Balu: Oh God, how it happened?</td>
</tr>
<tr>
<td></td>
<td><img src="image4.png" alt="Image" /></td>
<td>Balu: Mom, now both weighs equal.</td>
</tr>
<tr>
<td></td>
<td><img src="image5.png" alt="Image" /></td>
<td>Mother: The weight of a thing is not depending on its size but depends on the number of molecules it contains.</td>
</tr>
</tbody>
</table>
Bissy: Hi...son Dinesh...Don’t become hot in future by watching the size.

Balu scratch on his head.

Balu: Bissy...sorry...

Balu: Mom, we are ready. Let us go.

Mother: Yes, we can go. Bissy: Basheer hasn’t come yet.
<table>
<thead>
<tr>
<th>Basheer is coming by singing a song. He has worn a hat and spectacles.</th>
<th>Back-ground music</th>
<th>Basheer: Change .... change....... It is super change .....</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basheer has two green parrots in his hand.</td>
<td>Back-ground music</td>
<td>Mother: What is this? Is your father brought this? Basheer: Yes, Yes.</td>
</tr>
<tr>
<td>Balu to Bissy (secret)</td>
<td>Balu: Those are made with wax. We can play a trick. Bisssy: O.K.</td>
<td></td>
</tr>
<tr>
<td>Bissy coming with a lighted candle and fix it on the table.</td>
<td>Balu: Basheer your parrot is great. It can fly with the help of heat.</td>
<td></td>
</tr>
</tbody>
</table>
Methodology

Basheer: How is it?

Balu: If you need only one parrot, we can fly the other. If this parrot fly away it will not come back.
Basheer: You just fly it. I have no objection.

Bringing the parrot near to the lighted candle. Bissy closes Basheer’s eyes. When he opened his eyes the parrot is in melted form on the table and it looked like a flying parrot.

Background music
Balu: Basheer, our parrot is flying.

Mother: Balu you have flown the parrot. But how?

Basheer: Yes, how?
Bissy: I will tell. When wax is heated its density decreases and the molecules moves in a faster way.

Demonstrates the change of matter from solid to liquid state.
Methodology

Mother: When you heat this again the parrot changes to gaseous state and will really fly. This is because the wax molecules changes from liquid state to gaseous state.

Heating. The imaginary bird flying to the air.

STORY BOARD 15
ENTHU SUKHAMANEE KATTU

<table>
<thead>
<tr>
<th>Idea</th>
<th>Background</th>
<th>Visuals</th>
<th>Music</th>
<th>Characters and Dialogue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land breeze and sea breeze.</td>
<td>Sea breeze Land breeze It is the time of dusk.</td>
<td>[Visuals]</td>
<td>Background music</td>
<td></td>
</tr>
<tr>
<td>Balu, mother, Basheer and Bissy together reaches the sea shore. Music from background.</td>
<td></td>
<td>[Visuals]</td>
<td>Background music</td>
<td></td>
</tr>
</tbody>
</table>
Children playing in the waves. Mother is watching them.

Children ran towards mother and sat around.

Wind blows

Mother: It is enough. Stop play and all come here.

Mother: Now all of you should take some rest.

Balu: Oh…I feel cold.

Bissy: I like this wind.

Basheer: Mother, is this wind now blows from land to sea?

Mother: Yes, this wind is called land breeze.

Balu: Why is it blowing to the sea?
Mother: At night land lose warmth very soon. But sea lose warmth very slowly. The air in the land become cold, contracts and its pressure and density increases. As a result this air will blow towards the hot air above the sea, which is having low density and low pressure. This movement of air is called land breeze.

**Scene:** Cold and high density air filled atmosphere of the land in moonlight. Hearing lines of a song

**Song**

Enthusukhamane kattu…..

Enthusukhamane sandhya…..

**All of them standing up and enjoying the breeze.**

Bissy: Then, this breeze is called land breeze …..isn’t it?

Mother: Yes, it is.
| Scene: Hot air from the land moves up and the less hot air from the sea blows towards land. | Back-ground music | Basheer: Then, when did the sea breeze blows?  
Balu: In day time. At that time the air above the soil become hot soon. The density decreases and the air moves up and the pressure decreases, Then, the less hot air above the sea blows towards the land. |
|---|---|---|
| Hearing a song | Song | Mother: We will come back tomorrow at day time, to feel the sea breeze.  
Balu: Let us come tomorrow. Enthusukha-manee kattu..... Enthusukha-manee sandhya.. |

Figure 4.3 Story Boards for Animation
The Malayalam versions of sample story boards prepared for two lessons in Basic Science are given as Appendix III.

(iv) Preparation of Animated Visuals

Based on the story board animation programmes were prepared, covering 15 major concepts selected from the first three units of the Basic Science text book for standard VII and a name was assigned to each programme. The lessons in each unit were named as follows:

**Unit I** - **Pachayam Virippu**
- Lesson I - Pacha thanne Pacha
- Lesson II - Budding maman
- Lesson III - Dasanum Vijayanum
- Lesson IV - Sankarayinam Vithukal

**Unit II** - **Nam Samrakhshikkenda Jalam**
- Lesson I - Urul Pottal
- Lesson II - Mazhaveedu
- Lesson III - Jalachakram
- Lesson IV - Gulfashayam
- Lesson V - Sudhajalam Dhanyajalam
- Lesson VI - Ashaya Vaivedhyam

**Unit III** - **Thapam Pravarthikkumpol**
- Lesson I - Kattu Vellam Kudikkumbol
- Lesson II - Oru Veyiletal Athumathy
Lesson III - Ariyo? Avilo?
Lesson IV - Change Super Change
Lesson V - Enthu Sukhamanee Kattu

(v) Editing, Dubbing, Music effects and Narration

All these come under the post production stage. Editing of animation includes two steps, the rough cut of animation and the second is linear editing. The edited animations were transferred to a temporary drive and it was evaluated by both subject and technical experts. The programmes were re-edited based on their comments and suggestions.

A good animation programme should contain appreciable and appealing dubbing and special effects. Dubbing was done for the re-edited animation and needed effects and background music were included. At the end of each programme a narration about the key concept was included. The C. D. containing all the animation programmes is included as Appendix XXX.

(v) Preparation of Static Visuals

In this step, the investigator prepared or collected Static Visuals including charts, models, pictures, photographs etc. based on the facts, and major and minor concepts of the selected units.
4.7.2 Lesson Transcripts on Static Visuals based Instructional Strategy

From the units selected for teaching 15 lesson transcripts were prepared based on Static Visuals for teaching Experimental Group II. Static Visuals included charts, models and cartoons. Along with the lesson transcripts these visuals were also prepared. The sample lesson transcripts based on Static Visuals prepared by the investigator were given to experts for comments and feedback. Based on the feedback necessary modifications were made and a tryout was conducted. Then the lesson transcripts were again modified and restructured on the basis of the investigator’s actual experience.

4.7.2.1 Organization of Lesson Transcripts in Static Visuals based Instructional Strategy

In Static Visuals based Instructional Strategy each teaching unit is divided into lessons of 45 minutes duration. Each lesson focuses on a main idea of the unit and is progressing through the following five phases:

(i) Orientation
(ii) Elicitation
(iii) Presentation of Static Visuals
(iv) Reorientation
(v) Evaluation

The phases are schematically represented in the following figure:
Figure 4.4 Schematic representation of the progress of lessons in Static Visuals based Instructional Strategy.

Phase I  Orientation

The lessons in Static Visuals based Instructional Strategy starts with the learner’s initial confrontation with the task. Here the teacher provides an introductory orientation for the lesson.

Phase II  Elicitation

In the elicitation phase, opportunities are provided for pupils to explore and explain their ideas.
Phase III  Presentation of Static Visuals

Third phase is for presenting Static Visuals and the teacher presents the visuals and the ideas are concretized.

Phase IV  Reorientation

Fourth phase in this strategy is the reorientation phase and here the restructuring of ideas occurs.

Phase V  Evaluation

Evaluation is the final phase and it is used for strengthening the cognitive organization and it leads to the modification of behaviour of the pupils.

The Malayalam and English versions of Model lesson transcripts based on Static Visuals are given as Appendix IV&V.

4.7.3 Lesson transcripts on Conventional Activity Oriented Method

From the units selected for teaching in the control group 15 lesson transcripts were prepared based on Conventional Activity Oriented Method. The lesson transcripts were prepared by taking into account the instructional objectives. Provision was included regarding the terms, facts, concepts, principles etc. connected with the topics. Appropriate learning activities were included in the lesson transcripts.
4.7.3.1 Organization of Lesson Transcripts in Conventional Activity Oriented Method

In Conventional Activity Oriented Method each teaching unit is divided into lessons of 45 minutes duration. Each lesson progresses through the following six phases:

(i) Orientation
(ii) General Discussion
(iii) Group Activity
(iv) Presentation of Groups
(v) Compilation
(vi) Generalization
The phases are schematically represented in the following figure:

![Diagram](image)

**Figure 4.5** Schematic representation of the progress of lessons in the Conventional Activity Oriented Method.

**Phase I  Orientation**

Each lesson in the Conventional Activity Oriented Method starts with the learner’s initial confrontation with the task. Here the teacher provides an introductory orientation for the lesson.
Phase II  General Discussion

The second phase is the general discussion phase and pupils discuss various aspects of the topic, in the open class and the teacher watches the progress.

Phase III  Group Activity

In this phase pupils engage in small group activities and the leader of each group monitor the work in their group.

Phase IV Presentation of Groups

In the fourth phase, entitled presentation phase, the group representatives presents the findings of their group.

Phase V  Compilation

Compilation is the fifth phase in this method. Here comparing, supporting, opposing and modifying the ideas presented by the groups occurs, under the guidance of the teacher.

Phase VI  Generalization

This is the final phase in this method. Here, generalization and assimilation of information occurs, that leads to the behaviour modification of the pupils.
The Malayalam and English versions of the Model Lesson transcripts based on Conventional Activity Oriented Method are included as Appendix VI&VII.

4.7.4 Achievement Test

Since the aim of the study was to find out the effectiveness of Animated and Static Visuals on achievement in Basic Science of students at Upper Primary Level, the investigator prepared an achievement test based on the units I, II & III of Basic Science selected for teaching. The test was administered to the Experimental Groups and the Control Group as pre-test, post-test and delayed post test. In the present study the investigator prepared and standardized an achievement test in consultation with experts in the field. The steps involved are:

1. Planning the test
2. Preparation of the Design
3. Preparation of the Blueprint
4. Writing of items
5. Preparation of the Scoring Key

Planning the test

It was decided to construct a test for standard VII students based on the first three units of Basic Science. It was designed to measure behavioural outcomes in terms of the Instructional Objectives in science namely,
Knowledge, Understanding, Application, Analysis, Synthesis and Evaluation. The test consisted of objective type items only and the maximum mark fixed was 40. The duration of the test was 90 minutes.

**Preparation of the Design**

The investigator prepared a design for the test by giving due weightage to the various objectives, content areas and difficulty level. The test items were prepared by considering the objectives of the cognitive domain listed by Dr. Benjamin S. Bloom (1956). The details of the weightage given to objectives, content, difficulty level and form of questions, details of the blue print and scoring are given below:

**Weightage to objectives**

Due weightage has been given to the objectives namely, Knowledge, Understanding, Application, Analysis, Synthesis and Evaluation in the construction of the achievement test.

The weightage given to different objectives in the achievement test are presented in Table 4.2
**TABLE 4.2**

**Weightage to Objectives**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Instructional Objectives</th>
<th>Marks</th>
<th>Percentage of Marks</th>
<th>Number of questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Knowledge</td>
<td>10</td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td>2.</td>
<td>Understanding</td>
<td>13</td>
<td>32.5</td>
<td>13</td>
</tr>
<tr>
<td>3.</td>
<td>Application</td>
<td>14</td>
<td>35</td>
<td>14</td>
</tr>
<tr>
<td>4.</td>
<td>Analysis</td>
<td>1</td>
<td>2.5</td>
<td>1</td>
</tr>
<tr>
<td>5.</td>
<td>Synthesis</td>
<td>1</td>
<td>2.5</td>
<td>1</td>
</tr>
<tr>
<td>6.</td>
<td>Evaluation</td>
<td>1</td>
<td>2.5</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>40</td>
<td>100</td>
<td>40</td>
</tr>
</tbody>
</table>

**Weightage to Content**

During the preparation of the test items, proper weightage was given to all the units. The content area included three units, which was again divided into 15 lessons. The weightage given to each unit is given in Table 4.3

**TABLE 4.3**

**Weightage to Content**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Unit</th>
<th>Marks</th>
<th>Percentage of Marks</th>
<th>Number of questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Pachyam Virippu</td>
<td>12</td>
<td>30</td>
<td>12</td>
</tr>
<tr>
<td>2.</td>
<td>Nam Samrakshikkenda Jalam</td>
<td>10</td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td>3.</td>
<td>Thapam Pravarthikkumpol</td>
<td>18</td>
<td>45</td>
<td>18</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>40</td>
<td>100</td>
<td>40</td>
</tr>
</tbody>
</table>
Weightage to Difficulty Level

Proper weightage was given to the level of difficulty of the items. Due consideration was given to the bright, average and dull students. The weightage given to difficulty level of the test is shown in Table 4.4

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Difficulty Level</th>
<th>Marks</th>
<th>Percentage of Marks</th>
<th>Number of Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Easy</td>
<td>10</td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Average</td>
<td>20</td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>Difficult</td>
<td>10</td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>40</td>
<td>100</td>
<td>40</td>
</tr>
</tbody>
</table>

Form of Questions

All the test items included were of objective type. A distracter analysis was also done by the investigator at the time of preparing the test to eliminate the chances of guessing.

Blue Print of the Achievement Test

The blue print is a three dimensional chart showing the distribution of marks among the three dimensions, namely objectives, content and form of questions. The blue print prepared for the test is shown in Table 4.5
### TABLE 4.5

**Blue Print of the Achievement Test**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Objectives</th>
<th>Knowledge</th>
<th>Understanding</th>
<th>Application</th>
<th>Analysis</th>
<th>Synthesis</th>
<th>Evaluation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Form of Questions</td>
<td>Objective</td>
<td>Objective type</td>
<td>Objective</td>
<td>Objective</td>
<td>Objective</td>
<td>Objective</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Content</td>
<td>type</td>
<td>type</td>
<td>type</td>
<td>type</td>
<td>type</td>
<td>type</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Pachayam Virippu</td>
<td>4(4)</td>
<td>4(4)</td>
<td>4(4)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>2.</td>
<td>Nam Samrakshikkenda Jalam</td>
<td>3(3)</td>
<td>4(4)</td>
<td>3(3)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>3.</td>
<td>Thapam Pravarthikkumpol</td>
<td>3(3)</td>
<td>5(5)</td>
<td>7(7)</td>
<td>1(1)</td>
<td>1(1)</td>
<td>1(1)</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>10</strong></td>
<td><strong>13</strong></td>
<td><strong>14</strong></td>
<td><strong>1</strong></td>
<td><strong>1</strong></td>
<td><strong>1</strong></td>
<td><strong>40</strong></td>
</tr>
</tbody>
</table>

Number outside the bracket shows the marks.

Number inside the bracket shows the number of questions.
Writing of Items

The items were written as per the prepared blueprint and due weightage to the objectives, content and difficulty level was ensured. The items were presented before the experts and based on their comments and feedback necessary modifications were made.

Administration of draft test

The draft test prepared as per the blueprint was administered on a sample of 385 students of standard VII selected from five schools of Malappuram District. Random sampling procedure was employed for selecting the schools and obtained prior sanction from the authorities to conduct the test. The investigator himself administered the test with the help of teachers of the schools.

List of schools selected for the draft test:

**TABLE 4.6**

<table>
<thead>
<tr>
<th>SI.No.</th>
<th>Name of School</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>VAUPS, KAVANUR.</td>
<td>97</td>
</tr>
<tr>
<td>2.</td>
<td>GUPS, CHENGARA.</td>
<td>55</td>
</tr>
<tr>
<td>3</td>
<td>GMUPS, AREACODE.</td>
<td>101</td>
</tr>
<tr>
<td>4.</td>
<td>HMSAUPS, THURAKKAL, MANJERI.</td>
<td>85</td>
</tr>
<tr>
<td>5.</td>
<td>GUPS, PULLUR.</td>
<td>47</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>385</td>
</tr>
</tbody>
</table>
The scoring was done in accordance with the scoring key prepared by the investigator. The Malayalam and English versions of the draft form of the Achievement test, Scoring key and Response sheet given to students are shown as Appendices VIII, IX, X, and XI respectively.

**Item Analysis**

It is done by the investigator to establish the suitability of an item for inclusion in the final test. The quality of the test is based on the quality of each test item and hence each item should be analyzed by considering:

(i) Difficulty Index

(ii) Discriminating Power

The percentage of students who answer a particular item correctly is called the index of item difficulty. The Discriminating Power of an item is its ability to make discrimination between students who have achieved well and those who have achieved badly. For the study 370 answer sheets were selected and scored and were arranged in descending order. The upper 27% of answer sheets having the highest scores were termed as Highest Group and the lower 27% of answer sheets having the lowest scores were termed as Lower Group.

The formula used for calculating the Difficulty Index was:

\[ DI = \frac{(U+L)}{2N} \]
The investigator used the following formula for calculating the Discriminating Power:

$$DP = \frac{(U-L)}{N}$$

Where,

- $U$ = Number of right responses in the Upper Group
- $L$ = Number of right responses in the Lower Group
- $N$ = Number of students in each group

Items having Difficulty Index between 0.4 and 0.6 and Discrimination Power above 0.4 were selected. The details regarding the difficulty index and discrimination power of the items are given as Appendix XII.

**Preparation of the Final Test**

Out of the 50 items in the draft test 40 items were selected for the final test based on Difficulty Index and Discriminating Power. The duration of the test was 90 minutes. The Malayalam and English versions of the final form of Achievement Test are given as Appendices XIII & XIV.

**Preparation of Scoring Key**

It is prepared to make the scoring process objective. A scoring key consists of the correct answers to the items in the achievement test and marks.
allotted to each item. The final form of the Scoring key and Response sheet given to students are included as Appendices XV & XVI.

**Assessment of Reliability and Validity of the Test**

A test score is called reliable when we have reasons for believing the score to be stable and trustworthy. The reliability of the achievement test in Basic Science was established by using split-half method. Here the odd numbered items were treated as one half of the test and scored separately and the even numbered items were treated as the other half and scored for each examinee. After the application of the Spearman – Brown formula, the reliability coefficient was found to be 0.86.

**Validity of the Test**

Validity is that quality of a data gathering instrument or procedure that enables it to measure what it is supposed to measure. The type of validities considered during the test construction were:

**Content Validity**

Before the construction of the test, a thorough analysis of the content of the units selected from standard VII Basic Science text book in terms of the instructional objectives was done. The test was constructed keeping in view the weightage given for content area with objectives on one hand and the opinion and comments of experts on the other.
Statistical Validity

The statistical validity of the test was calculated by correlating the scores of the test with scores obtained by the students in Basic Science in the standard VI annual examination. The co-efficient of correlation obtained was 0.78 and thereby ensured the statistical validity of the test.

The chances for subjectivity in scoring was eliminated by including only objective type items and also by using scoring key for valuation. The test was in booklet form and was easy to administer. The usage of reusable test booklets along with separate answer sheets made the test economical and easy to administer.

4.7.5 SCIENCE ATTITUDE SCALE (SAS)

The Science Attitude Scale developed by Dr. Avinash Grewal (1990) is a dependable tool for measuring student’s attitude towards science. In the present study this tool was employed to collect data about the attitude of students towards science. The SAS consists of 20 statements, of which 10 items are positive statements and the rest negative. Item numbers 2, 4, 6, 8, 10, 12, 14, 16, 18 and 20 are positive statements and 1, 3, 5, 7, 9, 11, 13, 15, 17 and 19 are negative. This tool uses a five point scale to measure the attitude namely, Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D) and Strongly Disagree (SD).
Scoring

Each of the ten positive items of the scale are assigned a weightage ranging from 4 (Strongly Agree) to Zero (Strongly Disagree). In the case of ten negative items the scale scoring is reversed ranging from Zero (Strongly Agree) to 4 (Strongly Disagree). The Attitude score of a subject is the sum total of scores on all the twenty items of the scale. For each student a total score on the scale can be obtained by summatung his scores for the individual items. Thus a maximum of 80 scores can be obtained by a subject. The Malayalam and English versions of the SAS and the Scoring Key are included as Appendices XVII, XVIII and XIX respectively.

4.7.6 SCIENCE INTEREST INVENTORY (SII)

To understand the Interest in Science, the investigator prepared and standardized a ‘Science Interest Inventory’. The procedure followed in the preparation of the tool is described below:

After discussion with experts in the field of science and education, the investigator prepared 40 activities with three choices for the draft form of Science Interest Inventory. In each activity, one choice is related with the interest in learning Science and the other choices are related with other fields of knowledge. One mark is given to each correct response. Scoring sheets were given to the students to mark their choice from the given three
alternatives and they were analyzed to find out the Interest in learning Science.

**Try out**

The draft test prepared was administered to a sample of 385 students of standard VII selected from five schools of Malappuram District. List of schools taken for the draft test were:

<table>
<thead>
<tr>
<th>SI.No.</th>
<th>Name of School</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
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</tr>
<tr>
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<td>55</td>
</tr>
<tr>
<td>3.</td>
<td>GMUPS, AREACODE.</td>
<td>101</td>
</tr>
<tr>
<td>4.</td>
<td>HMSAUPS, THURAKKAL, MANJERI.</td>
<td>85</td>
</tr>
<tr>
<td>5.</td>
<td>GUPS, PULLUR.</td>
<td>47</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>385</strong></td>
</tr>
</tbody>
</table>

The teachers of the selected schools helped the investigator to administer the test in ideal conditions. The Malayalam and English versions of the draft Science Interest Inventory, Scoring key and Response sheet are included as Appendices XX, XXI, XXII and XXIII respectively.

**Item Analysis**

Each item in the test was subjected to Item Analysis in order to find out the two important characteristics of items namely:
(i) Difficulty Index

(ii) Discriminating Power

The percentage of subjects who answer a particular item correctly is known as the Index of Item Difficulty. The ability of the test item to differentiate between students who have achieved well and those who have achieved poorly is called Discriminating Power. All the score sheets were scored and then they were arranged in descending order. The top 27% of answer sheets having the highest scores were termed as Highest Group and the bottom 27% of answer sheets having the lowest scores were termed as Lower Group. The following formula was employed for calculating Difficulty Index:

$$DI = \frac{U+L}{2N}$$

The Discriminating Power was calculated by using the formula-

$$DP = \frac{(U-L)}{N}$$

Where,

$$U = \text{Number of right responses in the Upper Group}$$

$$L = \text{Number of right responses in the Lower Group}$$

$$N = \text{Number of students in each group}$$
After finding out the DI and DP, the items having Difficulty Index between 0.4 and 0.6 and Discriminating Power above 0.4 were selected. Table showing Difficulty Index and Discrimination Power of Science Interest Inventory is shown as Appendix XXIV.

**Preparation of the Final Test**

Out of the 40 items in the try out test only 25 items were selected for the final test. It was decided to give 45 minutes for answering. The English and Malayalam versions of the final form of Science Interest Inventory, Scoring key and Response Sheet are included as Appendices XXV, XXVI, XXVII and XXVIII respectively.

**Establishing Reliability and Validity**

The Reliability of the Science Interest Inventory was established by using split-half method. The reliability coefficient of the test was found to be 0.79. To find out the validity of the test, scores of 100 students selected at random are validated. The coefficient of correlation was found to be 0.92.

**4.7.7 NON-VERBAL INTELLIGENCE TEST**

The Non-Verbal Intelligence Test developed by Dr. Atmananda Sharma (2005) was used by the investigator to study the general mental ability of the students. The test material consists of
(i) Test Booklet
(ii) Answer sheet
(iii) Scoring key
(iv) Manual

The test contains a series of 25 visually presented problems. On the top half page there is a large square containing figures in three columns and three rows with a question mark in the right hand bottom corner instead of a figure. On the bottom half of the page there are 6 ‘answer’ figures. The individual is to choose one of these answer figures which should come in place of the question mark. The general instruction for taking the test are given in the beginning. Then specific directions for solving the problems are given on back side of general instructions. The test booklets are reusable and answers are recorded on separate answer sheet. A stencil key is available for checking the answers. The test is applicable to children of age 10 plus to 16 plus. The exact time allowed for the test is 15 minutes. The sample items of Non-Verbal intelligence Test are given below as figure 4.6
Figure 4.6 Sample items of Non-Verbal Intelligence Test
Scoring

Each correct response carries one mark. Hence the maximum possible mark is 25. If two or more choices have been marked for any single item, that item should be omitted from scoring. The response sheet of Non-verbal Intelligence Test is given as Appendix XXIX.

4.8 EXPERIMENTAL PROCEDURE

The study was conducted to find out the effectiveness of Animated and Static Visuals based Instructional Strategies for teaching Basic Science. For this purpose the investigator developed and standardized various tools.

After taking decision about the sample and tools to be used, the investigator obtained permission from the school authorities to conduct the study.

Prior to the experiment, the investigator compared the previous achievement of the selected groups in Basic Science and also administered the Non-Verbal Intelligence Test to compare the General Intelligence of the Groups selected for the study. The experimental procedure adopted was listed as:

(i) Administration of Pre-Achievement test in all groups.
(ii) Administration of Science Attitude Scale – Pre test
(iii) Administration of Science Interest Inventory – Pre test
(iv) Conducting classes for Experimental Group I using Animated and Static Visuals based Instructional Strategy.

(v) Conducting classes for Experimental Group II using Static Visuals based Instructional Strategy.

(vi) Conducting classes for Control Group through Conventional Activity Oriented Method.

(vii) Administration of Post Achievement test in all groups after experimental treatments.

(viii) Administration of Science Attitude Scale after experimental treatments (Post test)

(ix) Administration of Science Interest Inventory after experimental treatments (Post test).

(x) Administration of Achievement test (delayed post test) after one month for the three groups.

Phases of the Study

a) Experimental Group I – Pre tests → Teaching the topic using Animated and Static Visuals → Post tests → Delayed Post test.

b) Experimental Group II – Pre tests → Teaching the topic using Static Visuals → Post tests → Delayed Post test.
c) Control Group – Pre tests $\rightarrow$ Teaching the topic using Conventional Activity Oriented Method $\rightarrow$ Post tests $\rightarrow$ Delayed Post test

Total and objective wise scores of the post-test and delayed post test of the three groups were compared and the objectives selected were Knowledge, Understanding, Application, Analysis, Synthesis and Evaluation.

**Administration of Pre-tests**

To begin with the experiment, the investigator administered the pre-achievement test based on the first three units of standard VII Basic Science, to the three groups. Along with this the investigator also administered the Science Attitude Scale and Science Interest Inventory for the purpose of comparing the groups. A very clear idea about aim and scope of the study was given to the groups and their co-operation ensured. The answer sheets were collected from the students and scored.

**Learning by Experimental Groups**

After administering the pre-tests, the Experimental Group I was taught using Animated and Static Visuals based Instructional Strategy and Experimental Group II using Static Visuals based Instructional Strategy. There were 15 lessons and the duration of each lesson was 45 minutes.
Learning by Control Group

The Control Group was taught through Conventional Activity Oriented Method. The investigator explained the terms, facts, concepts, principles etc. related to the topic. Here also 15 lessons of 45 minutes duration was taught.

Administration of Post-tests

After the completion of experimental treatments, the investigator administered the Achievement test in Basic Science in both the Experimental Groups and also in the Control Group. The answer sheets were collected and scored as per the scoring key and subjected the data to statistical analysis.

After the completion of the experiment, the Science Attitude Scale and the Science Interest Inventory were administered again in all the groups as post tests. The scores obtained were subjected to statistical analysis to find out the effectiveness of the experimental strategies on the Interest in Science and also the Attitude towards Science. After one month, the Achievement test was conducted in all the groups (delayed post-test) to understand whether the experimental strategies have any effect on the retention of achievement of the students.

4.9 STATISTICAL TECHNIQUES EMPLOYED

The following statistical techniques were employed by the investigator to test the tenability of the hypotheses formulated:
**Mean:**

\[
\text{Mean} = \frac{\sum X}{N}
\]

Mean is obtained by dividing the sum of the scores by the total number of scores.

**Standard Deviation (SD)**

\[
\text{SD}, \quad \sigma = \sqrt{\frac{N \sum X^2 - (\sum X)^2}{N}}
\]

Where,

\[
\sum X = \text{Sum of ‘X’ scores}
\]
\[
\sum X^2 = \text{Sum of squares of ‘X’ scores}
\]
\[
N = \text{Number of sample.}
\]

**Critical Ratio (C.R)**

\[
\text{C.R.} = \frac{M_1 - M_2}{\sigma D}
\]

Where,

\[
M_1 = \text{Mean of first sample}
\]
\[
M_2 = \text{Mean of Second sample}
\]
\[
\sigma D = \text{Standard error of the difference between the means.}
\]
Standard Error

For correlated means

$$\sigma = \sqrt{\frac{\sigma_1^2}{N_1} + \frac{\sigma_2^2}{N_2}}$$

The pre-test and post-test scores of the experimental groups and control group were consolidated for statistical analysis. The mean and standard deviation of the scores of each pre-test were found out and ensured the equivalence of the groups by finding out the critical ratio and test of significance.

Analysis of Covariance

It is a method that enables the researcher to equate the pre-experimental status of the groups in terms of relevant known variables. Thus in the present study the ANCOVA was adopted for experimental comparison of performance between groups.

The pre-test and post-test scores of all the groups were consolidated for statistical analysis. Analysis of Covariance was also applied to test the effectiveness of Animated and Static Visuals based Instructional Strategies on Achievement in Basic Science at Knowledge, Understanding, Application, Analysis, Synthesis and Evaluation levels. Analysis of Covariance represents
an extension of Analysis of Variance to allow for the correlation between initial and final scores.

The procedure suggested and illustrated by Garret (2005) was followed for the Analysis of Covariance and it includes the following steps:

**Step I**

Determine the correction terms $C_x$, $C_y$ and $C_{xy}$ being correction of ‘$X$’ scores, ‘$Y$’ scores and ‘$XY$’ scores respectively which are required to make adjustments of the standard deviation calculated from original measures, taking zero as the assured mean. These are calculated by using the formula.

\[ C_x = \frac{(\Sigma x)^2}{N} ; C_y = \frac{(\Sigma y)^2}{N} ; C_{xy} = \frac{(\Sigma x)(\Sigma y)}{N} \]

Where,

$N =$ Number of scores of both the groups.

**Step II**

Calculation of total sum of squares (SS) for ‘$x$’, ‘$y$’ and ‘$xy$’.

These are calculated using the formulae:

Total (SS) for $x = \Sigma x^2 - C_x$

Total (SS) for $y = \Sigma y^2 - C_y$
Total (SS) for $xy = \Sigma XY - C_{xy}$

**Step III**

Calculation of sum of squares (SS) Among Group Means. Using the formulae:

For $x = \frac{(\Sigma X_1)^2 + (\Sigma X_2)^2 + (\Sigma X_3)^2}{n} - C_x$

For $y = \frac{(\Sigma Y_1)^2 + (\Sigma Y_2)^2 + (\Sigma Y_3)^2}{n} - C_y$

For $xy = \frac{(\Sigma X_1)(\Sigma Y_1) + (\Sigma X_2)(\Sigma Y_2) + (\Sigma X_3)(\Sigma Y_3)}{n} - C_{xy}$

Where,

$n$ = Number of scores in one group

$X_1, X_2, X_3 =$ The X scores of three groups.

$Y_1, Y_2, Y_2 =$ The Y scores of three groups.

**Step IV**

Calculation of Sum of Squares (SS) within groups.

For $x =$ Total SS for $x$ – Among Group Means SS for $x$.

For $y =$ Total SS for $y$ – Among Group Means SS for $y$. 
For \( xy = \) Total SS for \( xy \) – Among Group Means SS for \( xy \).

**Step V**

Analysis of Variance of X and Y Scores, taken separately.

\[
Fx = \frac{MSx(Vx) \text{ Among Groups}}{MSx(Vx) \text{ Within Groups}}
\]

\[
Fy = \frac{MSy(Vy) \text{ Among Groups}}{MSy(Vy) \text{ Within Groups}}
\]

Where,

\[
MSx(Vx) = \frac{SSx}{df}
\]

\[
MSyVy = \frac{SSy}{df}
\]

\( df = \) degrees of freedom.

**Step VI**

Computation of Adjusted SS for Y ie., \( SSy.X \)

\[
\text{Total SS} = y - \frac{(xy)^2}{x}
\]

\[
\text{Within SS} = y - \frac{(xy)^2}{x}
\]

\( \text{Among Means SS} = \text{Total SS} - \text{Within SS} \).

Analysis of Covariance \( Fy.x \)
Methodology

\[ F_{y.x} = \frac{MS_{y.x}(V_{y.x}) \text{ Among Means}}{MS_{y.x}(V_{y.x}) \text{ Within Groups}} \]

where, \( MS_{y.x}(V_{y.x}) = \frac{SS_{y.x}}{df} \)

**Step VII**

Correlation and Regression

Coefficient of Correlation \( r = \frac{\Sigma XY}{\sqrt{\Sigma X^2 \cdot \Sigma Y^2}} \)

**Step VIII**

Calculation of Adjusted Y means

\[ My.x = My-b \cdot (Mx-GMx) \]

**Step IX**

Testing significance of differences among adjusted Y means.

\[ S_{ED} = SD_{y.x} \sqrt{\frac{1}{N_1} + \frac{1}{N_2}} \]

Where \( S_{ED} = \text{Standard Error of difference between means.} \)

Then the ‘t’ value is calculated from table ‘D’ and by substituting in the equation \( t = D/S_{ED} \). Now we obtain the level of significance of difference at 0.5 or 0.1 level.

The details of analysis of data using appropriate statistical techniques are included in the next chapter.