Chapter – IV

Methodology of the Study
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METHODOLOGY OF THE STUDY

4.0 INTRODUCTION

The methodology of this present investigation is described under following sections, Objectives of the research study, Research questions, Hypotheses, Assumptions, Delimitations, Experimental design, Sample for the study, Construction and validation of tools, Data collection and Scheme of Data Analysis.

4.1 OBJECTIVES OF THE STUDY

The following are the objectives for this study

1. To design and develop Multisensory Integration Approach.

2. To implement the Multisensory Integration Approach on enhancing memory and achievement in science.

3. To find out the effect of the Multisensory Integration Approach on enhancing memory and achievement in science among students.

4.2 RESEARCH QUESTIONS

The investigation has to be done to find out answers to the following questions:

1. What is meant by Multisensory Integration Approach?

2. Can Multisensory Integration Approach be evaluated?
3. If so, how can it be evaluated?
4. Can the Multisensory Integration Approach be implemented?
5. If so, how can it be implemented?
6. Is the Multisensory Integration Approach effective on Science Teaching and learning at IX standard level?
7. If so, how far is it effective?
8. Does the Multisensory Integration Approach improve the memory and achievement in learning science?
9. What are the advantages of Multisensory Integration Approach in teaching and learning science?
10. Is there any difference between the Multisensory Integration Approach and conventional method in improving the memory and achievement of the learners?

4.3 ASSUMPTIONS

The following are the Assumptions for this study

1. Students in IX standard adopt some strategies to enhance memory and achievement in science.
2. Memory and achievement in science is dependent on Multisensory Integration Approach.
3. It is possible to design and develop Multisensory integration Approach to enhance the student’s memory and achievement in science.
4. Students could be oriented towards the Multisensory Integration Approach.

5. Memory and Achievement of the students could be enhanced by following the Multisensory Integration Approach.

4.4 DELIMITATIONS OF THE STUDY

The following are the Delimitations for this study

1. In the present study, students who are undergoing IX standard in science have only been selected as the sample.

2. All the students studying in the section A & B were selected for investigation.

3. The investigation is confined to boy students only.

4. The investigation has been carried out in Government Boys Higher Secondary School, Thirukogarnam, Pudukkottai.

4.5 HYPOTHESES OF THE STUDY

The following are the Hypotheses for this study

1. There is no significant mean difference between control and experimental group students in their Home environment, Anxiety and Achievement Motivation.

2. There is no significant mean difference between control and experimental group students in their achievement in pre-test.

3. There is no significant mean difference between control and experimental group students in their achievement in progressive test I.
4. There is no significant mean difference between control and experimental group students in their achievement in progressive test II.

5. There is no significant mean difference between control and experimental group students in their achievement in progressive test III.

6. There is no significant mean difference between control and experimental group students in their achievement in post-test.

7. There is no significant mean difference between pre-test and post-test Scores of achievement in control group.

8. There is no significant mean difference between pre-test and post-test scores of achievement in experimental group.

9. There is no significant mean difference between control and experimental group students in their memory in pre-test.

10. There is no significant mean difference between control and experimental group students in their memory in post-test.

11. There is no significant mean difference between pre-test and post-test Scores of memory in control group.

12. There is no significant mean difference between pre-test and post-test Scores of memory in experimental group.

13. There is no significant mean difference between control and experimental group of Memory Recall Test in pre-test.

14. There is no significant mean difference between control and experimental group of Memory Recognition Test in Pre-test.
15. There is no significant mean difference between control and experimental group of Visual Retention of Similar Pair Memory Test in pre-test.

16. There is no significant mean difference between control and experimental group of Visual Imagery Memory Test in pre-test.

17. There is no significant mean difference between control and experimental group of Memory Recall Test in post-test.

18. There is no significant mean difference between control and experimental group of Memory Recognition Test in post-test.

19. There is no significant mean difference between control and experimental group of Visual Retention Similar Pair Memory Test in post-test.

20. There is no significant mean difference between control and experimental group of Visual Imagery Memory Test in post-test.

21. There is no significant mean difference between pre-test and post-test of Memory Recall Test in control group.

22. There is no significant mean difference between pre-test and post-test of Memory Recognition Test in control group.

23. There is no significant mean difference between pre-test and post-test of Visual Retention Similar Pair Memory Test in control group.

24. There is no significant mean difference between pre-test and post-test of Visual Imagery Memory Test in control group.

25. There is no significant mean difference between pre-test and post-test of Memory Recall Test in experimental group.
26. There is no significant mean difference between pre-test and post-test of Memory Recognition Test in experimental group.

27. There is no significant mean difference between pre-test and post-test of Visual Retention Similar Pair Memory Test in experimental group.

28. There is no significant mean difference between pre-test and post-test of Visual Imagery Memory Test in experimental group.

29. There is no relationship between achievement and memory of post-test of the control group.

30. There is no relationship between achievement and memory of post-test of the experimental group.

4.6 EXPERIMENTAL DESIGN

The research design gives a holistic structure of the research procedure. It provides planning on selection of subject, data gathering devices and data analysis techniques in relation to objectives of research.

The experimental method is clearly the best for determining the causal effect of an isolated, single variable and dependent variable. It helps in answering research questions in a systematic and logical way. It is the best way to establish cause and effect relationships between variables.

This method is considered to be the best because it provides for a high degree of control over extraneous variables and the manipulation of variables.
The experimental method is a scientific method of research. It helps to test hypotheses of causal relationships between variables. It reduces bias and increases reliability. It gives a rationale for each and every step. It enables the researcher to go beyond description and prediction, beyond identification of what causes them. In experimental research the investigator has adopted a parallel group experimental design for the present investigation.

The present research has followed the two group pre-test post-test design. In this design subjects are assigned to the experimental group and the control group at random and are given a pre-test. The experimental group taught through Multisensory Integration Approach and the control group taught through traditional method. After which the two groups are measured on dependent variable.

4.1 Schematic representation of the experimental design

![Schematic diagram of experimental design]
4.7 EXPERIMENTAL THREATS

Experimental design should enhance experimental validity. Experimental validity depends on many factors. The careful control of extraneous variables characterizes good experimental research.

There are usually many possible ways to explain the outcome of a study.

The possibilities of such alternative explanations are usually referred to as threats to internal validity.

Threats to validity lead to ambiguous explanation of the data. According to Campbell and Stanlay (1963) the threats to experimental validity, may be classified into two categories (i) threats to internal validity ii) threats to external validity.

4.7.1 Threats to Internal validity

i) History

Specific external events occurring between the first and subsequent measurements and beyond the control of the experiment may affect the performance of the subjects. The threat due to this was minimized in the study providing the same conditions and settings to both the groups except for treatment. Moreover no specific noticeable instances affect any one group.

ii) Maturation

This would operate in situations where subjects select which treatment they would require. Scope for this was eliminated by random assignment of sample and treatment.
iii) Mortality

The experiment utilized an eight week span. There were no permanent loss of subjects; there were no permanent absentees either for the experimental group or control group. Hence the threat to experimental mortality was greatly minimized.

iv) Pre testing

This may produce practice effect on subjects resulting in their proficient performance on post – test.

The threat due to this was minimized in the study providing the same conditions and settings to both the groups.

v) Instrumentation

The threat from this factor was eliminated by using a standardized memory test and an achievement test prepared by the investigator as per established procedures discussed under instrumentation.

vi) Statistical regression

The possibility for statistical regression was absent in the present design since.

1. All the 60 pupils in IX class were used for the study.
2. The subjects were not selected for their extreme scores and
3. Instruments used were reliable.

vii) Selection Bias

Random assignment of treatments maintained the equivalence between groups to the extent possible.
4.7.2 Threats to external validity

i) Integration of selection and treatment

This was minimized because no scope was given for voluntary assignment of subjects and samples were drawn from a typical school.

ii) The Artificiality of the Experimental setting

The present study minimized this by conducting the treatments in the real classrooms, during the regular school hours.

iii) Reactive effects of experimental procedures

This threat also known as Hawthorne effect, makes the subjects aware that they are taking part in an experiment and that knowledge would alter the performance of the subjects. This was eliminated in the study by keeping the conditions same for both the groups as far as possible.

iv) Interaction Effect of Testing

The use of a pretest may sensitize subjects so that they would become aware of the concealed purpose of the experiment. This was avoided in the present study by pretest conducted to the control and experimental group.

4.8 VARIABLES OF THE STUDY

The present investigation is an attempt to determine the effectiveness of Multisensory Integration Approach on Enhancing Memory and Achievement in Science and to estimate the extent of relationship between selected variables in the most effective Multisensory Integration Approach.
a) The Multisensory Integration Approach is the independent variable in this study.

b) The Achievement score in science is the dependent variable.

c) The Memory score of the students is yet another dependent variable.

d) The other extraneous variables are as follows.
   
   i) Home environment ii) Anxiety iii) Achievement motivation.

4.9 OPERATIONAL DEFINITION OF THE KEY TERMS

“Effectiveness of Multisensory Integration Approach on Enhancing Memory and Achievement in Science among IX standard students”.

Effectiveness

The term ‘Effectiveness’ in this study refers to the increase in scores in percentage obtained by the learners in an achievement test designed by the researcher.

Multisensory Integration

Multisensory Integration is the subliminal process by which we merge and organize the information received from each and every sense into one cohesive mental picture of the natural environment.

Multisensory Integration Approach:

Teaching through the model developed and evaluated by the investigator based on different sensory modalities, such as sight, sound, touch, smell and taste.
Enhancing

It refers to the increase of learning science of students.

Memory

In psychology, memory is the process in which information is encoded, stored and retrieved.

Achievement

Achievement is the educational goal that is achieved by a student over a certain period.

Science

Science is a systematic enterprise that builds and organizes knowledge in the form of testable explanation and predictions about the universe.

4.10 EXPERIMENTATION IN PHASES

Phase: I

1. Understanding of the Multisensory Integration Approach.

2. Developing a systematic model for the application of multisensory integration approach instruction promoting memory and achievement in science.

Phase: II

4. Trying out the Effectiveness of Multisensory Integration Approach with a small group of students as pilot study.

5. Formation of two groups for conducting experiment, one is control group and another one is experimental group.

Phase: III

6. Conducting pre – test to assess the entry behaviour of the students in the classroom.

7. Administering of memory test to the students.

8. Comparing the control and experimental group students based on pre – test achievement scores so as to enable them to establishing the equality of the two groups by mean and standard deviation.

Phase: IV

9. The students of experimental group to be taught through Multisensory Integration Approach and control group to be taught through the traditional method of teaching.

10. Duration of the treatment would be of three months.

Phase: V

11. Administering the test after the completion of equal amount of portions allotted to the experiment so as to enable the investigator to administer three progressive tests.

12. Administering the posttest after the completion of instructional units
13. Entering, categorizing and analyzing the pre – test, progressive tests and post – test scores

4.11 SAMPLE FOR THE STUDY

4.11.1 Location

The present investigation has carried out in Government Boys Higher Secondary School. Thirukogarnam, Pudukkottai District. This is affiliated to the State Board of Higher Secondary Education, Government of Tamil Nadu.

4.11.2 Selection of the sample

The Simple Random Sampling Technique has followed in the Study. In the school selected for the study, the IX standard students were taken for investigation, 60 were selected out of 90 students (other than 30 those selected for pilot study) in the IX standard formed the sample of the study.

Out of 3 groups in IX standard, A group assigned as control group, B group assigned as experimental group and C group already taken for pilot study. Students were randomly assigned to form the two groups- control and experimental group. The pretest was conducted to the control and experimental groups fortunately their mean score are almost equal. To these two groups memory test was administered to measure the level of their memory.
4.12 DURATION OF THE TREATMENT

After assigning the two groups randomly as control and experimental, the investigator conducted the experiment. The student of the experimental group is thought through Multisensory Integration Approach and the control group is taught through traditional method.

4.1 Duration of various phases of experimentation

<table>
<thead>
<tr>
<th>S. No</th>
<th>Experimental Phases</th>
<th>Activity Carried out</th>
<th>Units</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Phase I</td>
<td>Understanding &amp; developing of multisensory integration approach model</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Phase II</td>
<td>Conducting pilot study for validation of multisensory integration approach model</td>
<td>Unit</td>
<td>3 weeks</td>
</tr>
<tr>
<td>3</td>
<td>Phase III</td>
<td>Formation of two groups i.e., control and experimental group.</td>
<td>Memory test &amp; achievement test were administered (Pre-test)</td>
<td>1 week</td>
</tr>
<tr>
<td>4</td>
<td>Phase IV</td>
<td>Experimentation by multisensory Integration Approach session through multisensory integration approach model in classroom.</td>
<td>unit 5, unit 6, unit 7, unit 8, unit 9</td>
<td>8 weeks</td>
</tr>
<tr>
<td>5</td>
<td>Phase V</td>
<td>Progressive tests were administered after completing equal amount of portions. Achievement post-test and Memory post-test were administered.</td>
<td>All units</td>
<td></td>
</tr>
</tbody>
</table>

Duration of Experiment = 3 months
4.13 TOOLS FOR THE STUDY

The investigator administered the tool of achievement test to measure the achievement (dependent variable) of the students in their science learning. The investigator also administered memory test to measure the level of memory. The tools used were the following.

1. Achievement test for learning science.
2. Memory test.
3. Home environment scale.
4. Anxiety inventory.
5. Achievement motivation inventory.

4.13.1 Achievement test

This is a generalized test of achievement in science for high school students of standard IX. It was constructed and validated by the investigator. The test included questions of objective type, very short answer type and short answer questions.

Part: A- Choose best answer

1. Atomic Number of He
   a) 1    b) 2    c) 3    d) 4

2. BeCl Molecule is a
   a) Ionic bond    b) Metallic bond
   c) Covalent bond  d) Co-ordinate covalent bond
Part: B- Fill in the blanks

1. Copper is a __________ metal

2. Water molecule is a ______________ compound.

Part: C- Matching items

1. C^{11}  –  NaCl

2. M-Orbit  –  Brain scan.

3. Ionic bond  –  3^{rd} energy level

Part: D- Very short answer questions

1. What is sublimation?

2. Define: Electron

Part: E- Short answer questions

1. Explain the formation of water molecule with a diagram.

2. Explain Bhor’s Theory of Atomic model.

Scoring

The scoring scheme of the test items is as given below:

a) Multiple choice items

One mark for each correct answer.

Zero score for each incorrect answer.

Number of items – 10.
b) **Fill in the Blanks**

One mark for each correct answer

Zero score for each incorrect answer

Number of test items – 10.

c) **Matching Items**

One mark for each correct answer

Zero score for each incorrect answer

Number of test items – 10.

d) **Very short answer type**

Two marks for each correct answer

Number of test items – 5.

e) **Short answer type**

Five marks for each correct answer

Number of test items – 2.

**Reliability of the tool**

The reliability of the Achievement test was found by parallel form method and it was found to be 0.86 which was significant.

**4.13.2 Memory test**

The content based memory test is used by investigator to assess memory of the students. The content based memory test is modified form of the PGI Memory Scale. The PGI Memory scale was constructed and standardized by Dwarke
Pershad (1988). PGI Memory scale was developed by Postgraduate Institute for Medical Education and Research (PGIMER) at Chandigarh in India. The investigator has modified PGI Memory scale to suitable for chemistry content. It includes 10 subtests of which the investigator used the following 4 subtests only. The investigator established its reliability by split-half method and it was to be 0.74

i) Memory Recall Test.

ii) Memory Recognition Test.

iii) Visual Retention Similar Pair Memory Test.

iv) Visual imagery Memory test.

**i) Memory recall test**

Participants are presented with stimuli and then after10 minutes they are asked to remember as many of the stimuli as possible.

Investigator gives sample of the body of content. Students should carefully read it and memorize for specific period of time. After that they should write correct response to the appropriate stimuli.

**ii) Memory Recognition test**

Investigator gives the body of content. Students carefully read it and memorize for specific period of time. After that the investigator asked them to select the best possible answer out of the choices from a list.
iii) **Visual retention similar pairs Memory Test**

The investigator gives a list of pairs. The students read it for specific period of time. After that the investigator gives a list of single terms; the students have to write the correct pair.

iv) **Visual imagery test**

The investigator shows a card to the students. After a gap of 20 seconds the card is removed from the sight of the subjects. The investigator asks the students to draw what they have seen in the card. They draw in the paper from their memory the scene which they have seen.

**Scoring**

i) **Memory Recall test**

One mark for each correct response

Zero score for each incorrect response

Number of stimuli – 10

ii) **Memory Recognition test**

One mark for each correct response

Zero score for each incorrect response

Number of stimuli – 10.

iii) **Visual retention similar pair Memory Test.**

One mark for each correct response

Zero score for each incorrect response

Number of stimuli – 10.
iv) Visual Imagery Test

Two marks for each correct response

Zero score for each incorrect response

Number of stimuli – 5.

The investigator also administered Home Environment scale, Anxiety inventory, and Achievement motivation inventory to measure the level of Home Environment, Anxiety level and Achievement Motivation in order to establish the equality of the groups. The tools used were the following:

1. Home Environment Scale (validated by Murugeswari 1993)
2. Anxiety inventory (Validated by R. Mukundan and S.S. Sindhu1993)
3. Achievement Motivation inventory (validated by Prayag Metha1994)

4.13.3 Home Environment Scale

Home environment scale validated by T. Murugeswari (1993) was used for the present investigation to measure the Home Environment of the students. The scale consists of 32 items with two alternative responses for Yes/ No. For each the respondents were required to tick (√) against their chosen responses. For the response 'Yes' one mark was given and for 'No" response to the items, 'zero' mark was given.

a) Examples for the items

1. Have your parents given you a separate room for study? Yes/No
2. Are your parents help in improving your memory power? Yes/No
The total mean score ranges from 0 to 32. The content validity of the tool was established. The reliability of the tool was also established and found to be 0.78. The Investigator also established the reliability of the tool by KR 20(0.77) method.

4.13.4 Anxiety inventory

To measure the level of Anxiety, the investigator used the Anxiety inventory developed by R. Mukundan and S.S. sindhu (1993). Anxiety inventory included three variables Manifest Anxiety, Death Anxiety and Social Anxiety. It consisted of items in three sections in the form of statements and declarations the form of A,B,C,D, & E. The items included both positive and negative questions.

a) Examples for the items

Positive items

1. I have confidence in me
2. Usually I am happy

Negative items

1. Many around me are trying to poison me.
2. Due to tension I have disturbed sleep.

Scoring

The inventory consisted of 48 items. Each item had 5 alternative responses. They were scored as follows: Four positive items- 5 marks for A, 4 for B, 3 for C, 2 for D, 1 for E. For the negative statements the scoring was in the reverse order.
The reliability of the inventory was found to be 0.76, the validity of the inventory was also established (by face and content validity) with the opinions of Experts. The total score range from 48 to 240. The investigator also established its reliability by KR 20 (0.79) method and it was found to be significant.

4.13.5 Achievement Motivation inventory

To measure the level of Achievement Motivation of the students, the investigator used the standardised achievement inventory developed by Prayag Metha (1994). It contained 22 items with 6 alternatives each of which the respondents were required to tick (√). The reliability of the tool was found to be 0.80.

i) Scoring procedure

The Achievement Motivation inventory consisted of 22 items. Each item was followed by six responses of which two were Achievement Related (AR) two were Task Related (TR) and the rest were unrelated (UR). The numbers given against each item under AR, TR and UR showed the nature of numbered responses. For example responses numbered 2 and 5 out of the six responses under item number 1 are (AR) responses numbered 1 and 4 are TR and responses numbered 3 and 6 are (UR). The responses to any one item can be either AR or TR or UR.

AR responses carry a score of 2.

TR responses carry a score of 1.
UR responses carry a score of 0 (Zero). The sum of the scores was converted into percentage. Thus gives the individuals achievement score was arrived at.

ii) Example

Two boys are standing, facing the mountain.

1. They are enjoying the beauty of nature.
2. They are planning to climb up to the highest peak of the mountain.
3. They are studying the herbs available on the mountain.
4. They have become tired after a lot of walking and are just relaxing.
5. They are thinking about the new techniques of mountaineering.
6. They are thinking of writing a report after having inspected the mountainous region.

The possible scores range from 0-44

The present investigator also established reliability by KR 20 (0.82) method and it was found to be similar to the reliability measure of the inventory.

4.14 DATA COLLECTION

The IX standard students were randomly assigned to form two groups, control and experimental group. Experimental group students were taught through Multisensory Integration Approach. Control group students were taught through
traditional method. Initially they were administered the following tools to find out the level of their achievement.

1. Memory Test
2. Achievement Test.

During the course of instruction at regular intervals progressive tests were conducted. The marks scored in the three progressive tests were computed for analysis. Finally a post – test was conducted after the completion of all portions. The reliability of the progressive tests and the posttest were established. They were found to be significant.

4.15 SCHEME OF DATA ANALYSIS

In the present study the relevant data obtained from test scores of 60 students in the pretest, progressive tests and the posttest have been analyzed as follows.

i) Descriptive analysis

This generates information about the nature of a particular group of individuals. Mean and standard deviation were calculated to determine the central tendencies and dispersion of variables.

ii) Differential analysis

This tool involves determination of statistical significance of difference between the groups with reference to selected variables. It involves ‘t’ test.
iii) Correlation analysis

Pearson product moment Correlation was used to find out the significant relationship between the variables.

4.16 CONCLUSION

The current chapter has thus presented the modus operandi followed for the study. The quantitative and qualitative data thus obtained were subject to analysis and interpretation, which lead to Chapter V of this report.