Enhancing Science Teaching Through Effective Multisensory Integration Approach

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ABSTRACT
Sensory integration takes place in the central nervous system where complex interactions such as co-ordination, attention, arousal levels, autonomic functioning, emotions, memory and higher level cognitive functions are carried out. Sensory integration gets information through the senses, puts it together with prior knowledge, information and memories already stored in the brain to make a meaningful response. Multi-sensory learning, as the name implies, is the process of learning a new subject matter through the use of two or more senses. This may include combining visual, auditory, tactile or kinaesthetic, olfactory and gustatory sensation. By activating brain regions associated with touch, flavour, audition and vision, they indicate a direct relationship between perceptual knowledge and sensory brain mechanisms. The present research study to find out effectiveness of Multisensory Integration Approach to Enhancing Achievement on Science among IX Standard Students reveals that activating appropriate processes through Multisensory Integration Approach plays a vital role in improving achievement in science. Further it is observed that the Multisensory Integration Approach expands the learning schema, since the learner is able to activate appropriate sensory integration. This contributes to meaningful and joyful learning. This facilitates the teacher’s task of enabling the students to apply Multisensory Integration Model on enhancing learning.

Keywords: Multisensory Integration, Approach, Achievement, Science

Introduction
We live in a world rich in sensory information. This information is conveyed through various forms of stimulus energy (e.g.,
chemical, mechanical, electromagnetic, thermal etc.), and our sensory systems have evolved specialized peripheral organs to transduce these energies into a common neural code (i.e., action potential). Remarkable efforts in neuroscience research over the past fifty years have focused on understanding the nature of these transduction processes, and on elucidating the “neural code” for each of the sensory systems.

Intriguingly, this work has largely focused on understanding these processes within the individual sensory systems, and as a result we have a detailed understanding of the mechanics of the transduction and encoding events within the visual, auditory, somato-sensory, vestibular, gustatory and olfactory systems. However, intimate knowledge of these events in each of these sensory systems is ultimately inadequate for understanding the nature of our perceptual gestalt, since this unity is built also from the synthesis of information across the different senses. Numerous examples serve to highlight the powerful ability that the different sensory systems have in influencing one another and ultimately to shape our view of the world around us. One of the most entertaining of these examples is that of the ventriloquist; in which discordant visual cues (i.e., the movements of the dummy’s lips and head) can dramatically alter our judgments about the source of an auditory signal (Thurlow and Jack 1973). In this particular example we refer to the ability of the visual cues to bias our localization of an auditory signal. In addition to these biasing effects under discordant conditions, visual cues can also dramatically improve the intelligibility of an auditory signal when presented in spatial concordance.

Although these perceptual examples are compelling, they are not the reasons why the different sensory systems have evolved with the capacity to influence one another. These reasons are undoubtedly rooted more in changes in behavioural processes mediated by multiple sensory inputs.

**Multisensory Integration Approach**

Multi-sensory learning, as the name implies, is the process of learning a new subject matter through the use of two or more senses. This may include combining visual, auditory, tactile or
kinaesthetic, olfactory and gustatory sensation (Scott, 1993). By activating brain regions associated with touch, flavour, audition and vision, they indicate a direct relationship between perceptual knowledge and sensory brain mechanisms (Barsalou, 1999). In Multisensory Integration approach, a child gets the opportunity to see, hear, touch, feel, taste, handle, and smell. Such sensory experiences are caused by external environmental stimulations. These result in perception; it develops from impressions or an awareness of sensations caused by an environmental stimulus which requires little interpretation. Perceptions are primary factors in thinking which often initiate a train of thought.

When perceptions are recalled at some later time without the use of external stimuli, the memories and images are already formed. The perception in the form of images and memories develop into greater abstractions called concepts. The concept is usually organised as a result of many related sensation, percept and images with verbal symbols incorporated.

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

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

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

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

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

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

**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 affect 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 an experimental design for the present investigation.

The present research has followed the two group pre-test post-test designs. 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 was taught through Multisensory Integration Approach and the control group taught through traditional method. After which the two groups are measured on dependent variable.

### Schematic Representation of The Experimental Design

```
TM  |  TM  |  TM  |  TM  
Control group | Pre-test | Progressive test- I, II, III | Post-test 
(TM)           | (Achievement) | (Achievement) | (Achievement) 
MSIA | MSIA | MSIA | MSIA 
Experimental group | Pre-test | Progressive test- I, II, III | Post-test 
(TM)           | (Achievement) | (Achievement) | (Achievement) 

TM = Traditional Method, MSIA=Multisensory Integration Approach
```

### 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.

### 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. 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:**

8. The students of experimental group to be taught through Multisensory Integration Approach and control group to be taught through the traditional method of teaching.
9. Duration of the treatment would be of three months.

**Phase V:**

10. 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.
11. Administering the post-test after the completion of instructional units.
12. Entering, categorizing and analyzing the pre-test, progressive tests and post-test scores.
Sample for the Study

Location: The present investigation was carried out in Government Boys Higher Secondary School at Thirukkotarnam, Pudukkottai District. This is affiliated to the State Board of Higher Secondary Education, Government of Tamil Nadu.

Selection of the sample: The Simple Random Sampling Technique was 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 pre-test was conducted on the control and experimental groups; fortunately their mean scores are almost equal. To these two groups memory test was administered to measure the level of their memory.

Tools for the Study

1. Achievement Pre-test for Science.
3. Achievement post-test in Science.

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. Multisensory Integration Approach
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 post-test were established. They were found to be significant.

**Scheme of Data Analysis**

In the present study the relevant data obtained from test scores of 60 students in the pre-test, progressive tests and the post-test 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 to determine the difference.

The above table shows the ‘t’ value of Achievement in pre-test, Progressive test I, Progressive test II, Progressive test III and post-test in control and experimental groups.

There is no significant difference between the mean scores of the two samples at the beginning of the study. This shows both the control and the experimental groups are comparable and the entry level before the treatment was begun.

The calculated ‘t’ value is **6.41** which is greater than the table value. Hence there is significant Mean difference between the control and experimental group in progressive test-I.

The calculated ‘t’ value is **17.49** which is greater than the table value. Hence there is significant Mean difference between the control and experimental groups in the progressive test-II.

The calculated ‘t’ value is **17.57** which is greater than the table value at 0.05 level. Hence there is significant Mean difference between the control and experimental groups in the progressive test-III.

The calculated ‘t’ value is **31.64** which is greater than the table value at 0.05 level. There is significant Mean difference between the control and experimental groups in the posttest.
Hence the Multisensory Integration approach is more effective than the Traditional method in science learning.

Table 1 — Differential Analysis of Achievement in Pre-test, Progressive test I, Progressive test II, Progressive test III and Post-test

<table>
<thead>
<tr>
<th>S.No</th>
<th>Test</th>
<th>N</th>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
<th>“t” value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pre-test</td>
<td>30</td>
<td>Control</td>
<td>21.53</td>
<td>6.76</td>
<td>0.11</td>
<td>NS*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30</td>
<td>Experimental</td>
<td>21.36</td>
<td>5.56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Progressive test-I</td>
<td>30</td>
<td>Control</td>
<td>23.76</td>
<td>3.53</td>
<td>6.41</td>
<td>S*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30</td>
<td>Experimental</td>
<td>31.36</td>
<td>5.56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Progressive test-II</td>
<td>30</td>
<td>Control</td>
<td>24.40</td>
<td>2.60</td>
<td>17.49</td>
<td>S*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30</td>
<td>Experimental</td>
<td>42.20</td>
<td>5.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Progressive test-III</td>
<td>30</td>
<td>Control</td>
<td>27.53</td>
<td>3.35</td>
<td>17.57</td>
<td>S*</td>
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<tr>
<td></td>
<td></td>
<td>30</td>
<td>Experimental</td>
<td>53.20</td>
<td>6.77</td>
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</tr>
<tr>
<td>5</td>
<td>Post-test</td>
<td>30</td>
<td>Control</td>
<td>28.30</td>
<td>1.82</td>
<td>31.64</td>
<td>S*</td>
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<td>30</td>
<td>Experimental</td>
<td>61.10</td>
<td>5.23</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N = 30  NS* = Not Significant  S* = Significant  0.05 level

Figure 1 — Comparison for Achievement Mean scores of Pre-test, Progressive test-I, II, III and Post-test in control and experimental groups
Findings

The following are the findings of the study:

1. It is found that the achievement mean scores of control and experimental group are similar in pre-test. Hence the two groups are equivalent before the treatment.
2. It is found that the achievement mean scores of experimental group are greater than the control group in progressive test I.
3. It is found that the achievement mean scores of experimental group are greater than the control group in progressive test II.
4. It is found that the achievement mean scores of experimental group are greater than the control group in progressive test III.
5. It is found that the achievement mean scores of experimental group are greater than the control group in post-test. Therefore the Multisensory Integration Approach is more effective than the traditional method.
6. It is found that the achievement mean score of post-test of control group is marginally increased than the pre-test.
7. It is found that the achievement mean scores of post-test of experimental group are greater than the pre-test.

Educational Implications

The present study was undertaken to check the effectiveness of Multisensory Integration Approach on teaching of Science. This model was developed by the investigator keeping in mind basics and application of sensory integration. This model leads the educational aims towards the higher academic achievement as it was prepared specifically for that purpose. The statistical treatment of data revealed the effectiveness of this model in enhancing memory on learning in Science. The major findings are:
The Multisensory Integration Approach Model significantly enhances the memory of the students.

Teacher should be given proper orientation towards the Multisensory Integration Approach.

Teacher should be trained to develop Multisensory Integration Approach Model for various disciplines and chapters.

Multisensory Integration Approach provides better opportunities to the learners to take part in the process of learning activity.

Conclusion

The present research study “Effectiveness of Multisensory Integration Approach on Enhancing Memory and Achievement in Science among IX Standard Students” reveals that activating appropriate processes through Multisensory Integration Approach plays a vital role in improving achievement in science. Further it is observed that the Multisensory Integration Approach expands the learning schema, since the learner is able to activate appropriate sensory integration. This contributes to meaningful and joyful learning. This facilitates the teacher’s task of enabling the students to apply Multisensory Integration Model in enhancing achievement.

It is found that Memory in Science is improved by learning through the Multisensory Integration Approach Model. Hence, educational planners, administrators and curriculum designers should play a vital role in restructuring teacher education courses at all levels with the incorporation of Multisensory Integration Approach components. This will certainly develop the Memory of the students in Science. This research study highlights the need for optimum utilization of the Multisensory Integration Approach to gain maximum educational benefits to the society.
References