CHAPTER VI
SUMMARY, EDUCATIONAL IMPLICATIONS, RECOMMENDATIONS AND SUGGESTIONS
CHAPTER VI
SUMMARY, EDUCATIONAL IMPLICATIONS, RECOMMENDATIONS AND SUGGESTIONS

6.0 Introduction

This chapter presents a brief summary of all the chapters presented in the Study. It includes the rationale and significance of the Study, statement of the problem, Delimitation, objectives, hypotheses, variables of the Study, operational definition of the key terms, methodology of the Study, major findings of the Study. The chapter concludes with a discussion on the educational implications, recommendations, suggestions for further research and conclusions.

6.1 Rationale and Significance of the Study

Science education has great importance in achieving the goals of education and is an indispensable part of school curriculum. Creative Thinking and Attitude towards Science are two important outcomes of science education. More Studies needs to be conducted in this area so as to improve science education and its outcomes. Though traditional methods of teaching science have been effective, better teaching methods that give due importance to these two outcomes need to be studied.

Although the Project of Science Curriculum Development in Yemen (2000) gave emphasis to the development of Creative Thinking, Achievement in Science and Attitude towards Science most of the teachers were not aware of these learning outcomes as they are not oriented in these lines, partly because of insufficiencies in the in-service training inputs they have received.

The problem of the Study and its significance is premised on the following sources: the Investigator’s feeling and experience in the field as a science teacher and through his supervision of student teachers as a demonstrator, as well as through his observation of the traditional methods followed in schools which were characterized by complete activeness on the part of the teacher and complete passivity on the part of the students, also, a number of recent studies such as (Al-Dobai, 2004; Al-Homaidi, 1999;
Al-Hudabi & Al-Doais, 1995; Mie, 1999; Raweh, 2001; Bamoqabel, 2007) which have indicated that the Achievement of Yemeni students in science is very low due to the use of traditional methods. In addition, the researcher has found that Creative Thinking and Attitude towards Science is a neglected aim of school teaching and most students have a negative attitude towards science lectures because they feel that learning process is based on theoretical knowledge which they cannot employ in their ‘practical’ life. Also, students feel that there is a gap between the syllabi they learn at school and their actual day-to-day needs. Besides, the World Bank report issued in New York in 2008 observes that “Yemen is ranked penultimate in the field of education at the level of the Middle East and North Africa”. All of these indicators require a serious re-consideration of the educational process. The present study is nothing but a step towards achieving this goal.

Nevertheless, several studies were conducted on the low level of Achievement in Yemen, using modern methods and strategies such as cooperative learning, concept map, learning cycle, inquiry, problem solving, constructive learning, brainstorming, and structured education etc. The results of these studies indicate that there is a positive effect in favor of the experimental group in the development of the achievement, attitude, science processes, decision-making, and thinking. Nevertheless, there is not any improvement in the deployment of the Creative Thinking and Attitude towards Science, and the day-to-day constituent of teaching of science has not paid considerable attention.

Furthermore, although several studies were made on the pedagogical deficiencies in the educational system in Yemen, little has been done with regard to Dimensions of Learning Model. Consequently, this study acquires importance by attempting a close examination of the effect of Dimensions of Learning Model on Achievement in Science, Creative Thinking and Attitudes towards Science, focusing on eighth standard students in Yemen as a case in point.

6.2 Statement of the Problem

The problem of the present study is stated as follows:

"Impact of Marzano’s Dimensions of Learning Model on Achievement in Science, Creative Thinking and Attitude towards Science among Students of Eighth Standard".
6.3 Delimitation of the Study

Following delimitations were the self imposed restrictions by the Investigator due to paucity of time, limited availability of resources and several other aspects that cannot be covered in the present Study due to practical constraints.

1. The Study was confined to science subjects of the eighth standard only. Moreover, only a sample of four class of eighth standard was taken as the representative sample of the higher primary school students of Ibb city-Yemen country.
2. The Study was limited to Achievement in Science, Creative Thinking and Attitude towards Science.
3. The Study was carried during the period October-December in the academic year 2011/2012.
4. The Study was confined to two Arabic government higher primary schools (boys' school & girls' school).

6.4 Methodology of the Study

The present Study was carried in two phases

1. Preparation and developmental Phase
2. Experimentation phase

6.4.1 Preparation and Developmental Phase

This phase includes the details objectives, hypotheses, variables used in the study, operational definition of the key terms, selection of the Model, selection of content, Preparation of the instructional material and pilot Study of the instructional material.

6.4.1.1 Objectives of the Study

The following are the objectives of the Study:

1- To develop the instructional material based on Marzano’s Dimensions of Learning Model to teach few units of science to the students of eighth standard.
2- To study the effect of Marzano’s Dimensions of Learning Model on Achievement in Science of students of eighth standard.

3- To study the effect of Marzano’s Dimensions of Learning Model on Creative Thinking of students of eighth standard.

4- To study the effect of Marzano’s Dimensions of Learning Model on Attitude towards Science of students of eighth standard.

5- To study the difference between males and females in Achievement in the Science.

6- To study the difference between males and females in Creative Thinking.

7- To study the difference between males and females in Attitude towards Science.

8- The relationship between Achievement in Science and Creative Thinking of students of eighth standard.

9- To study the relationship between Achievement in Science and Attitude towards Science of students of eighth standard.

10- To study the relationship between Attitude towards Science and Creative Thinking of students of eighth standard.

6.4.1.2 Hypotheses of the Study

The following are the hypotheses of the Study:

**H1:** There is no significant difference between the Experimental Group and the Control Group in Achievement in Science.

**H2:** There is no significant difference on Creative Thinking between the Experimental Group and the Control Group.

**H3:** There is no significant difference between the Experimental Group and the Control Group in Attitude towards Science.

**H4:** There is no significant difference between males and females in Achievement in Science.

**H5:** There is no significant difference between males and females in Creative Thinking.
H6: There is no significant difference between males and females in Attitude towards Science.

H7: There is no relationship between Achievement in Science and Creative Thinking.

H8: There is no relationship between Achievement in Science and Attitude towards Science.

H9: There is no relationship between Attitude towards Science and Creative Thinking.

6.4.1.3 Variables Used in the Study

The following variables are considered in the study.

A. Independent Variable

Teaching method: Dimensions of Learning Model and traditional teaching method.

B. Moderate Variables

Gender is only a moderate variable in this study.

C. Dependent Variables

iv. Achievement in Science
v. Creative Thinking
vi. Attitude towards Science

6.4.1.4 Operational Definitions of the Key Terms

Some of the key terms that are used in this Study are defined operationally as follows.

6.4.1.4.1 Dimensions of Learning Model

Instructional Model translating research from dimensions of thinking into a practical Model that teachers of any content area can utilize to improve the quality of teaching and learning in the classroom. These dimensions of thinking are: (i) the positive attitude and perceptions about learning, (ii) acquiring and integrating knowledge, (iii) extending and refining knowledge to access to new results, (iv) using knowledge
meaningful, and (v) development of using of productive mind habits (Davidson & Worsham, 1992, 8; Marzano, 1992, 12).

In this Study, Dimensions of Learning Model is a set of teaching procedures that the Investigator follows while teaching the Experimental Group. It allows the learner to acquire new knowledge and integrate it with the old one. With the passage of time, the learner develops new knowledge through class activities that help him/her to extend and refine his/her knowledge and use it in meaningful ways. The entire process of learning takes place within a set of positive attitudes and perceptions which are often influenced by mental productive habits.

6.4.1.4.2 Traditional Teaching Method

The Traditional method of teaching consists mainly of giving lecture by the instructor and expecting students to be cognitively active but physically inactive, except for note taking. Most students of any age cannot maintain such behaviour for a long period of time Cangelosi (2003). One aspect of the traditional method of teaching is that it has a tendency to view students as passive learners because it does not engage them actively.

In this Study, Traditional Teaching Method refers to the method of teaching that depends on both lecturing and discussion along with posing oral questions in a limited way while teaching the control group. This method encourages students to learn lessons by heart.

6.4.1.4.3 Achievement in Science

Science Achievement refers to a tangible accomplishment of proficiency in chemistry, physics and biology measured using an Achievement Test based on the six levels of Bloom Taxonomy.

Thus Achievement in Science in the present Study is the total score obtained by the students in the Achievement test constructed by the Investigator.
6.4.1.4.4 Creative Thinking

Torrance defines Creative Thinking as the process of sensing difficulties, problems, gaps in information, missing elements, something new; making guesses and formulating hypotheses about these deficiencies, evaluating and testing these guesses and hypotheses; possibly revising and retesting them; and finally communicating the results (Torrance, 1988, 47).

The present Study defines Creative Thinking as the student’s ability to produce the largest number of ideas and solutions to the problems he/she faces in the Torrance Test of verbal Creative Thinking that is composed of six activities. The Test was confined on measure the abilities of fluency, flexibility and originality.

i. **Fluency** is the number of responses.

ii. **Flexibility** is the degree of difference of the responses.

iii. **Originality** is statistical infrequency of response.

6.4.1.4.5 Attitude towards Science

Attitude towards Science denotes interest or feeling towards studying science. It is the students’ disposition towards ‘like’ or ‘dislike’ science (Olatunde, 2009, 336).

The present Study defines Attitude towards Science as the student’s response-positive or negative-on an Attitude Scale towards science content. It is measured in terms of the favourableness estimated by the points scored by the students on an Attitude Scale towards science.

6.4.1.4.6 Reaction of Students

In this Study, the reaction of students has been measured by their own opinion. The students are free to write down their response with regard to Dimensions of Learning for teaching science, over and above their Achievement Test.

6.4.1.4.7 Eighth Standard

The educational system in Yemen consists of primary school (1st to 6th standard), Higher primary (6th to 9th standard) and Secondary school that means High school (10th to
12th standard), then university stage. Eighth standard follows higher primary stage that plays an important and substantial role in the future of students.

6.4.1.5 Selection of the Dimensions of Learning Model for the Study

With the consultation of Guide, subject experts and the science teachers, it was decided to teach science lessons through Dimensions of Learning Model.

6.4.1.6 Selection of Content

The science subject of eighth standard was chosen to teach through Marzano’s Dimensions of Learning Model. The topics for the intervention program were selected from the science textbook prescribed for eighth standard students of Ibb city, Yemen for the academic year 2011-2012.

6.4.1.7 Preparation of the Instructional Material based on Dimensions of Learning Model

While preparing the instructional material, the five units and weightage given to each unit related to science textbook (science, 2012) of eighth standard considered.

Lesson plans for the Experimental Group were taught through Dimensions of Learning Model which were prepared based on the guidelines provided by Marzano (1992). Twenty four lesson plans in Arabic language were prepared for fifty two sessions with the time duration of forty five minutes for each session.

6.4.1.8 Pilot Study of the Instructional Material based on Dimensions Learning Model

The examples, exercises, activities and the instructional objectives thus included in the instructional material based on Marzano’s Dimensions of Learning Model were discussed with the Guide, subject experts, experienced science teachers and teacher educators and subjected to pilot study on the students of eighth standard to ensure the following:

- The feasibility of the Marzano’s Dimensions of Learning Model.
- The suitability of the Model for the given age group.
- Adaptability of the Model by the Investigator.
6.4.2 Experimentation Phase

The phase includes the details of the design, sampling procedure, sample for the study, homogenizing the groups, tools used in the study and procedures followed during the experimentation.

6.4.2.1 Design of the Study

The present Study was carried out to study the effectiveness of Marzano’s Dimensions of Learning Model on the Achievement in Science, Creative Thinking and Attitude towards Science, the instructional material based on Marzano’s Dimensions of Learning Model was subjected to experimentation in which the participants were randomly assigned to the Experimental and Control Groups. The ‘Randomized Groups, Pre-test, Post-test Design’ was selected for the Study.

6.4.2.2 Sampling Procedure

The population for this Study consisted of students of eighth standard in Ibb city, Yemen. The randomly sampling technique was employed in order to select the schools of the Study. Ibb city has two districts, Al-Mashna and Adhehar. Adhehar district was selected randomly. Two public schools were selected randomly in Adhehar district; Anahda School for males and Sana School for females. In each selected schools, two classrooms were randomly chosen. Each one of the two classrooms, were randomly assigned, one for Dimensions of Learning Model and the other for traditional teaching approach.

6.4.2.3 Sample for the Study

Finally the sample was reduced to one hundred and eighty five students. The sample included 91 males and 94 females in total. The details of the sample selected for the study is given in the table 6.1.
Table 6.1: Details of the Sample for the Study

<table>
<thead>
<tr>
<th>School Group</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>45</td>
<td>48</td>
<td>93</td>
</tr>
<tr>
<td>Control</td>
<td>46</td>
<td>46</td>
<td>92</td>
</tr>
<tr>
<td>Total</td>
<td>91</td>
<td>94</td>
<td>185</td>
</tr>
</tbody>
</table>

6.4.2.4 Homogenizing the Groups

The Investigator should make the Experimental Group and the Control Group equal on their level of Science Achievement in previous semester and Intelligence of the same students.

The result of analysis of homogenizing the groups indicates that the difference between the mean scores of science Achievement in previous semester and Intelligence for the Experimental and Control Groups are not significant at the alpha level of 0.05. Also, the result revealed that the difference between the mean scores of science Achievement in previous semester and Intelligence for males and females are not significant at the alpha level of 0.05.

6.4.2.5 Tools Used in the Study

To get the data on the variables selected for the study, various tools were used. The following table gives the details of the tools and the purpose for which they were used.
Table 6.2: Tools Used and their Purpose

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Tools Used</th>
<th>Author</th>
<th>Variable Measured</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Non Verbal Intelligence Test</td>
<td>Ahmed Zaki Saleh</td>
<td>Intelligence</td>
</tr>
<tr>
<td>2</td>
<td>Achievement Test in Science</td>
<td>Investigator</td>
<td>Pretest and post test levels on Science Achievement</td>
</tr>
<tr>
<td>3</td>
<td>Creative Thinking Test</td>
<td>Paul Torrance</td>
<td>Pretest and post test levels on Creative Thinking</td>
</tr>
<tr>
<td>4</td>
<td>Attitude Towards Science Scale</td>
<td>Investigator</td>
<td>Pretest and post test levels on Attitude towards Science</td>
</tr>
<tr>
<td>5</td>
<td>Reactions Scale</td>
<td>Investigator</td>
<td>Reactions of students on Marzano’s Dimensions of Learning Model</td>
</tr>
</tbody>
</table>

6.4.2.6 Implementation of Intervention Program

It was carried out in four stages:

i. Administration of pre-tests

ii. Intervention program

iii. Administration of post-tests

iv. Data analysis and statistical techniques used

6.4.2.6.1 Administration of Pre-tests

The final form of the tools was administered as pre tests to the students of both the Experimental and Control Groups for measuring Intelligence, Science Achievement in previous semester, Achievement in Science on the selected units, Creative Thinking and Attitude Scale towards Science.
6.4.2.6.2 Intervention Program

The Experimental Group was taught through Dimensions of Learning Model. The Experimental and Control Groups were taught by the Investigator. This phase includes teaching-learning-activities and evaluation for Experimental Group and teaching Control Group by traditional teaching approach.

6.4.2.6.3 Administration of Post-tests

After the completion of the intervention program both the Experimental and Control Groups were post tested on all the dependent variables; Achievement in Science, Creative Thinking and Attitude towards Science. Along with this, a reaction scale was administered to the Experimental Group to know the reaction of students towards Dimensions of Learning Model adopted in teaching science.

6.4.2.6.4 Data Analysis and Statistical Techniques Used

The collected data were analyzed both quantitatively and qualitatively.

I. Quantitative Analysis

Quantitative analysis was done to test the significance of difference between the Experimental and Control Groups and also males and females using the appropriate statistical techniques.

The following statistical techniques were used to analyze the collected data and for testing the hypotheses of the study:

Descriptive Statistics

Descriptive statistics are used to provide the information about the measures of central tendency and variability of the variables – Mean and S.D.

Student ‘t’ test

The ‘t’ test was used to find the significance of difference between the post-means of the Experimental and Control Groups and males and females on Achievement in Science, Creative Thinking and Attitude towards Science.
Pearson’s Product Moment Correlation

This technique was used to find out the correlation between Achievement in Science, Creative Thinking and Attitude towards Science.

II. Qualitative Analysis

The students’ reactions about the Dimensions Learning Model Approach were also analyzed qualitatively.

6.5 Major Findings of the Study

The findings of the Study are given under the respective heads.

➢ There is a significant difference between post-means of the Experimental Group and Control Group in Achievement in Science and it is also implied that the Experimental Group exhibited the higher Achievement in Science than the Control Group.

➢ There is a significant difference between post-means of the Experimental Group and Control Group in Creative Thinking and it is also implied that the Experimental Group exhibited the higher Creative Thinking than Control Group.

➢ There is a significant difference between the Experimental Group and Control Group in Attitude towards Science and it is also implied that the Experimental Group exhibited the higher Attitude towards Science than Control Group.

➢ There is no significant difference between the post-means of males and females in the Experimental Group on Achievement in Science.

➢ There is no significant difference between the post-means of males and females in the Experimental Group on Creative Thinking.

➢ There is no significant difference between the post-means of males and females in the Experimental Group on Attitude towards Science.

➢ There is a positive relationship to the extent of 0.49 between Science Achievement and Creative Thinking of the Experimental Group.

➢ There is a positive relationship to the extent of 0.31 between Science Achievement and Attitude towards Science of students.
There is a positive relationship to the extent of 0.26 between Creative Thinking and Attitude towards Science of students.

Analysis of the students’ reactions towards Dimensions of Learning Model revealed that eighty nine percent of them liked Dimensions of Learning Model and also expressed that this Model helped them in learning the science content meaningfully.

6.6 Educational Implications of the Study

The following are the educational implications of the present Study:

1. The Dimensions of Learning Model is found to be effective on science achievement, Creative Thinking and Attitude towards Science of eighth standard students.

2. Dimensions of Learning Model need to be introduced for teaching science as it has significant impact in bringing desirable development among students’ Creative Thinking and Attitude towards Science.

3. The instructional material prepared based on the Dimensions of Learning Model can be used to teach science while teaching any lesson irrespective of the lesson prescribed. Therefore the Dimensions of Learning Model may be implemented in the schools for the advantage of students.

4. It was found from the present Study that Achievement in Science as well Creative Thinking and Attitude towards Science were improved in the Experimental Group. Therefore, Dimensions of Learning Model may be utilized for teaching selected topics in different school subjects like mathematics, social science and language to promote better student Achievement, Creative Thinking and Attitude towards Science.

5. Schools need to shift their emphasis from dictator classroom to democratic classroom, from passive receptors to active participant, from rigid daily program to active flexible schedule, from teacher dominated classroom to child directed and group activities and from memorizing to problem awareness.

6. According to the results of the Study, Dimensions of Learning Model is more effective than conventional method of teaching science in fostering Achievement
in Science. In this approach the learners come to learning situations with knowledge gained from previous experience and that prior knowledge determines what new knowledge they will construct from new learning experiences. It emphasizes extending and refining knowledge and using knowledge meaningfully rather than memorization of concepts.

7. The Study asserts democratic classroom environment where in the priority is given to the students’ autonomy and the relationship between students and teacher and among the students. Students liked work in cooperative groups because they got an opportunity to discuss and share knowledge with each other.

8. With regards to the Attitude of students towards Science, the Investigator found it important to investigate the effects of teacher variables on students’ Attitude towards Science. There appears to be strong evidence that teacher’ Attitude towards Science courses, teaching and attitude towards their students also determine how students respond to and achieve better scores in science courses. The teacher should be proficient in his knowledge and expertise in methods.

9. It was found that Dimensions of Learning Model was effective in developing Creative Thinking among the students. During the treatment the students were given opportunity to develop the skills of fluency, flexibility and originality. From the results of this Study, it is suggested that the teachers should provide suitable learning environments where the students are encouraged to get involved in answering the questions which are not immediately apparent.

10. The Study asserts the need to change the classroom environment for promoting Creative Thinking through cooperative learning, providing opportunities for students to perform classroom activities.

6.7 Recommendations

There are several recommendations that could be made to science teachers, school administrators and educational researchers regarding implementation of Dimensions of Learning Model at higher primary school level based on the results of the present Study.

The following are recommendations based on the findings of this Study:
The higher primary teachers should use Dimensions of Learning Model while teaching science subjects in addition to constructivist approaches in learner-centered classrooms.

Teachers at pre-service stage as well as in-service stage should be given training in Dimensions of Learning Model as well as in how to develop Creative Thinking of students.

Teachers also should be trained in application of Dimensions of Learning Model appropriately according to the need of their classrooms.

Having established that development of Creative Thinking and Attitude towards Science as essential factors in science education, they should be made part of science curriculum.

Teacher education programs in Yemen should incorporate training for a variety of approaches included in Dimensions of Learning Model such as cooperative learning, K.W.L, brainstorming, thinking aloud, etc.

Content of science textbook should be designed based on Dimensions of Learning Model.

Dimensions of learning Model is applicable across all content areas and standard levels so the school administration should design guidebook including how to implement Dimensions of Learning Model.

6.8 Suggestions for Further Research

The present Study comes up with the following insights for further research on Dimensions of Learning Model of teaching:

The Study may be replicated for various standard levels and for different content areas in science to confirm the generalizability of the results and conclusions of the study.

The Study can be replicated with other populations, including the students at secondary level or college level and using more classes in different schools and with more sophisticated experimental designs.
Similar studies on the same topics may be conducted in different provinces of Yemen with larger samples of students by incorporating suitable psychosociological variables.

Extension of the same study to other subjects like mathematics, social science and languages may be taken up.

A comprehensive study may be taken up to cover all sections of the science subject.

The study can be extended to investigate the effect of Dimensions of Learning Model on other variables like anxiety, motivation, problem solving ability, critical thinking.

The study can be carried out to investigate the thinking skills included in the questions of general science syllabuses of the lower and higher basic stage in Yemen in the light of Marzano Model.

Further research need to be carried out to assess the suitability of Dimensions of Learning Model classroom vis-à-vis traditional classroom for students belonging to different levels of intelligence and achievement.

6.9 Conclusions

The study has indicated that the use of Dimensions of Learning Model bring out a higher level of academic achievement, Creative Thinking and Attitude towards Science among higher primary school students.

Student-centered approaches such as Dimensions of Learning Model enhance science achievement and creative thinking. Thus, the Dimensions of Learning Model focuses on shifting from ‘what and how much’ the students have learnt to ‘how the students learn’. Therefore, teachers in schools, especially teachers who teach science need to be aware of the benefits and importance of Dimensions of Learning Model and thus to change the practice of teacher-centered teaching methods to student-centered teaching methods.

The Dimensions of Learning Model was more interesting to the students. The findings of this study had further established the fact that acceptable methods of instruction are capable of changing students' attitude towards science.