Summary, Findings and Conclusion

5.01 Introduction

Gardner (1993) argues that human beings possess a number of distinct intelligences that manifest themselves in different skills and abilities and thus referred to them as Multiple Intelligences. All human beings apply these intelligences to solve problems, invent processes, and create things. Psychologists and Educationists debate the issue of whether intelligence is a single construct or several.

The theory of multiple intelligences offers eight ways or styles of teaching and learning. In this regard, armed with the knowledge and application of the multiple intelligences, teachers can ensure they provide enough variety in the activities they use so that their pupils’ learning potential can be tapped as much as possible (Berman, 1998).

And hence, the major aim of this research was to introduce student to the MI approach to teaching. Multiple Intelligence Theory goes beyond being an intelligence theory; rather it is an educational philosophy showing how students learn and how teachers should teach (Hoerr, 1997:43). There are some researches based on this such as, Poole’s (2000: 532)
clear description of an MI classroom seems to be helpful in understanding the potential of the theory in practice. In an integrated and cooperative MI classroom, the teacher employs non-traditional approaches to construction of meaning through a flexible but careful planning. The small social groups and learner-centred activities enable the students to share information and get a better understanding of what is learnt. In such a relaxed and non-threatening learning environment that is characterized by contextual clues, learners receive comprehensible input by working collaboratively. These characteristics of an MI classroom, as described by Poole, lead the researcher to the conclusion that MIT is inclusive of many familiar approaches such as whole language, cooperative learning, and other appropriate pedagogies that take children beyond the limits of rote learning (2000: 540). Alghazo, Obeidat, Al-trawneh and Alshraideh (2009) found in their study that the percentages of existence of multiple intelligences in the social studies, Arabic language and English language textbooks is acceptable, hence they recommend holding training sessions for the teachers of the first three grades who teach these courses and train them on accomplishing these intelligences so they can achieve the goals in the best qualified way. They also recommend putting a scale for the multiple intelligences for each textbook and each grade so that it flows in a logical way that is suitable with the developmental characteristics of the students.

5.02 Rationale of the Study

As for the importance of this theory for the learners it gave them the chance to discover real life situations and to look at it from different views, the person can go back and relive the different life situations through different living abilities. In addition the application of the theory gives the student the ability to depend on himself more and
provides him with the ability to apply new skills and improve group learning and also improves their academic achievement as suggested by Thabet, (2005). The approach acknowledges the individual differences while enabling students to meet the demands of the lessons. Students are thus able to accomplish their school work and engage well in lesson activities. Moreover, there is a stimulation of their mind, thought processes, interests and highlights the individual’s talents and abilities which can be developed for further growth.

Also various studies are done with the Mathematics subject viz. **Onika Douglas, , Kimberly Smith Burton, Nancy Reese-Durham (2008)** experimental study regarding achievement of eight grade students, **Ozlem Dogan Temur (2007)** experimental study on Achievement and Permanency of four grade students and **Divina G. Naoe (2010)** descriptive survey with maths, science and English subjects of fifth grade learners. All of them concluded that students performance in different subject areas will remarkably improve if activities inspired by the MIT will be integrated in the lessons.

Similarly Ayten İflazoglu Saban (2011) conducted qualitative descriptive survey with Science and Technology subjects on 4,5,6,7 and 8 Grade teachers and thus concluded that learners could learn better and permanently if they are subjected to this theory. Needless to say that the theory of MI and its application by teachers to modify their styles to accommodate individual differences among learners goes a long way in changing the form of the classroom teaching and learning.

Although Mathematics is an important subject in the school curriculum, many students find it difficult to master. The researcher feels that the MI approach can help students to
develop an interest and understanding in Mathematics. All this led to the conclusion that
the teacher can use the multiple intelligence teaching module to educate their students to
be more conscious and reflective in their thinking abilities and in the different methods of
learning. It also helps teachers to understand the differences which they realize among
their students and choose the suitable teaching methods in light of the individual
differences between them. Hence the study was planned with the main aim of studying
the extent to which MIT can be applied to the mathematics teaching. In order to
accomplish this it was proposed to compare the conventional teaching method of
Mathematics teaching with that using a module based on MI. The students of class eight
were considered for the study and their achievement in Mathematics was taken as the
dependent variable. Here in this study only girls students are considered as it was found
that the most common belief among people is that Mathematics is not a girly subject
rather that of home science especially in U.P. Board and students themselves tend to feel
tough that one. Hence if Mathematics is taught up by some other method (not
conventional one), it would create interest and fun among them. Also up to class eight in
U.P. Board it is compulsorily to study Mathematics so if we are able to divert students
mind that Mathematics is also rather more important and enjoyable subject as others then
it would be fruitful to us as well as to them also.

5.03 Research Questions

This study was undertaken to find solutions to the following research questions:

1. Is the Multiple Intelligence Teaching Module effective for improvement of
   achievement in Mathematics of Eight class students as compared to the conventional
   method?
2. Is the Multiple Intelligence Teaching Module effective for concept retention in Mathematics of Eight class students as compared to the conventional method?

3. Is the Multiple Intelligence Teaching Module help to prevent concept attrition in Mathematics of Eight class students as compared to the conventional method?

5.04 Statement of the Problem

The above questions, when formally expressed, lead to the statement of the problem:

Development of Multiple Intelligence Teaching Module in Mathematics for Upper Primary Level.

5.05 Objectives of the Study

The study was undertaken with the following objectives:

5.05.1 Main Objectives

1. To develop Multiple Intelligence Teaching Module in Mathematics for class eight.

2. To study the effectiveness of Multiple Intelligence Teaching Module in comparison to the conventional method in terms of achievement in Mathematics for class eight girl students.

5.05.2 Secondary Objectives

1. To study the concept retention in Mathematics of class eight girls students being taught through Multiple Intelligence Module and students taught through conventional method over a period of time after the termination of treatment.
2. To study the concept attrition in Mathematics of class eight girls students being taught through Multiple Intelligence Module and students taught through conventional method over a period of time after the termination of treatment.

5.05.3 Concomitant Objectives

To develop Criterion Referenced Test in Mathematics for class eight girl students.

5.06 Operational definitions of key terms

The key terms related to study are:

Multiple intelligence Teaching Module – It is the teaching module where the teacher uses the eight areas of intelligences as proposed by Gardner in making the module that is how to teach the particular topic with the help of Gardner’s Multiple Intelligence theory.

Upper Primary Level –

In this study Upper Primary Level refers to the 6th, 7th and 8th classes of U.P. Board however for this study students of class eight have been taken. Therefore here upper primary refers to class eight. Also primary level point to 1st to 5th classes and secondary from 9th to 12th classes.

Other terms used in the study:

Achievement in Mathematics-

Scores obtained by the eight class students on the criterion referenced test developed by the investigator on the selected chapters of the mathematics syllabus prescribed by the U.P. Board for class eight students.
Retention of Knowledge-

This refers to the ability to reproduce and apply the acquired knowledge after a fixed duration of time. Effective retention is one in which the knowledge can be applied to different situations with the same zeal and robustness even after duration of not less than six months. In the present study, long–term retention (Bacon and Stewart, 2006) (measured after a period of six weeks) is considered for practical reasons. In the present study it is given by the difference between delayed Post Test and Pre Test scores.

Attrition of knowledge

This refers to the slow loss or slow abrasion or gradual wearing off the knowledge with time. It differs from forgetting in the sense that even though in case of attrition the knowledge or information are present in long term memory but it can be accessed in its complete form. It is not forgotten entirely but can be retrieved only partially due to gradual decay or wearing off. In the present study it is given by the difference between delayed post test scores and posttest scores.

5.07 Population

The population for the present study was class eight students studying in Hindi medium, U.P. Board School in Mau city.

5.08 Sample

Two intact sections, out of five sections of class VIII in the school, that is section ‘A’ and ‘C’ of class VIII were randomly chosen as the sample of the study. Out of these two sections that is ‘A’ and ‘C’ of class VIII, by coin flipping section ‘A’ was randomly
chosen as the experimental group and other section ‘C’ as control group. Total of 64 students were selected out of which 32 are from control group and 32 are from experimental group.

5.09 Tool used in the study

Criterion Referenced Test in Mathematics was developed by the investigator to asses the achievement of class eight students in Mathematics. There were 50 items based on the selected eight chapters. The reliability of the test

5.10 The Experiment

The entire experiment consisted of four phases, the pre-treatment phase, treatment phase, the post-treatment phase and delayed post-treatment phase. The steps involved and the various activities performed in each of these phases are summarized in table below:

Table 5.1

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Phase</th>
<th>Duration</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Pre-Treatment</td>
<td>1 Day</td>
<td>Both the groups that is E and C were administered the pre test (to measure achievement)</td>
</tr>
<tr>
<td>2.</td>
<td>Treatment</td>
<td>47.33 Hours ( 71 periods of 40 minutes duration)</td>
<td>Taught the selected chapters to Group E By Multiple By Conventional</td>
</tr>
</tbody>
</table>

Schematic Representation of the Experiment
<table>
<thead>
<tr>
<th></th>
<th>Intelligence Teaching Module</th>
<th>Method</th>
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<tbody>
<tr>
<td>3.</td>
<td>Post-Treatment</td>
<td>2 days, 1 day for each group</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Immediately after the treatment, both the groups that is E and C were administered Posttest-I (to measure achievement)</td>
</tr>
<tr>
<td>4.</td>
<td>Delayed Post-Treatment</td>
<td>2 days, 1 day for each group</td>
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<tr>
<td></td>
<td></td>
<td>After a gap of six weeks from the treatment, both the groups that is E and C were administered Posttest-II (to measure knowledge-retention and to assess knowledge-attrition)</td>
</tr>
</tbody>
</table>

5.11 Data Collection

i) At the pre-treatment stage

Pre-treatment was administered in the month of August 2014. This included administering of the pre-test i.e. the achievement test in mathematics on both the groups i.e. experimental group and control group.

ii) At the post-treatment stage

Immediately after the treatment, the post-test I was administered to both the groups.

iii) At the delayed post-treatment stage
Six weeks later the posttest-II was administered to both the groups under the same physical condition. All answer sheets were scored on the basis of the scoring key. The marks were tabulated and subjected to statistical analysis.

5.12 Data Analysis

In order to arrive at meaningful inferences related to different objective of the present study, the descriptive statistics- mean, median, mode, standard deviation, skewness, kurtosis, variance and inferential statistics- ANOVA, ANCOVA and ‘t’ test were used.

5.13 Findings

(All hypotheses have been tested at the 0.01 level of significance as here the sample is small and the z value exceeds 2.58 )

Objective wise findings of the study are as follows:

5.13.1 Findings related to Major Objective 2

A Significant difference was found in the achievement of class eight students in Mathematics taught through Multiple Intelligence Teaching Module and those taught through conventional method ($F_{x,x}=124.15$). The experimental group with a mean of posttest scores of 42.906 outperformed the control group with a mean of posttest scores of 33.906.

5.13.2 Findings related to Secondary Objective 1

A Significant difference was found in the mean concept retention gain scores of class eight students in Mathematics taught through Multiple Intelligence Teaching Module and
those taught through conventional method ($t=20.60$). The experimental group with a mean concept retention gain scores of 24.03 outperformed the control group with a mean concept retention gain scores of 5.28 on the delayed posttest.

5.13.3 Findings related to Secondary Objective 2

A Significant difference was found in the mean attrition values (retention loss) of class eight students in Mathematics taught through Multiple Intelligence Teaching Module and those taught through conventional method ($t=4.66$). The experimental group with a mean attrition values (retention loss) of 3.34 was significantly lower when compared to that of the control group with a mean attrition values (retention loss) of 7.718.

5.14 Conclusion

- The Multiple Intelligence Teaching Module is significantly more effective than the conventional method in the improvement of achievement in Mathematics of eight class students.
- The Multiple Intelligence Teaching Module is significantly more effective than the conventional method for concept retention in Mathematics of eight class students.
- The Multiple Intelligence Teaching Module is significantly more effective than the conventional method for concept attrition (retention loss) in Mathematics of eight class students.

Thus, in short we may conclude that the Multiple Intelligence Teaching Module is significantly more effective than the conventional method in the improvement of
achievement in Mathematics, concept retention in Mathematics and for preventing concept attrition (retention loss) in Mathematics of eight class students.

5.15 Educational implications of the study

The conclusions based on the finding of the present study lead towards some educational implications for the students, for teachers, for teacher educators and for curriculum developers. However a few implications of the study are given below:

5.15.1 Implications for students

- Multiple Intelligence Teaching Module as an instructional method would be helpful to raise the achievement levels of students.

- Besides adding to the clarity of concepts, Multiple Intelligence Teaching Module will lead to the formation of strong linkages with related topics. Thus Multiple Intelligence Teaching Module would be helpful to the students for enhancing retention of topics in their cognitive structure.

- Multiple Intelligence Teaching Module would be helpful to the students for preventing concept attrition (retention loss).

- During the preparation of board exams and other competitive exams Multiple Intelligence Teaching Module can also be used by the students as revision tools.

- Multiple Intelligence Teaching Module can be used by the students for identifying gaps in their knowledge, if any, and hence in convincing them about the continuity of subjects matter.
• Multiple Intelligence Teaching Module can be used by the students for learning those topics, which they think are not clear, at the beginners level.

5.15.2 Implications for Curriculum Developers

➢ Multiple Intelligence Teaching Module would help in curriculum development and designing. The present study reveals that to learn a concept meaningfully, the students should have acquired the existing sub-concepts and interrelationships among them. Thus the textbooks should stress on in-depth conceptual knowledge instead of factual, superficial and unrelated knowledge.

➢ The syllabus should not be heavily loaded with facts and it is commonly seen that in the name of revision of the syllabus, books become bulkier with incorporation of more facts. Thus curriculum developers should incorporate concepts in place of facts and new information with respect to the concerned objectives.

5.16 Suggestions for Further Research

Besides the above educational implications, the experiences gained during this investigation, have enabled the investigators to make following suggestions for further research:

• The present study basically compares the effectiveness of two teaching methods that is Multiple Intelligence Teaching Module and conventional method. Replicated studies comparing other teaching methods to method based on Multiple Intelligence can also be undertaken.

• The present study was conducted in a ‘Girls’ school only so as to control the gender variable in the study. Study should also be conducted by taking only
‘Boys’ students or in a coeducational school to find out the effectiveness of Multiple Intelligence Teaching Module where gender is no longer controlled.

- This study covered Mathematics chapters of eight class syllabus prescribed by U.P. Board, similar studies can be conducted taking wider content area not only in Mathematics but also in other disciplines on syllabus of other boards and interdisciplinary courses.

- This study was conducted at upper primary level of education. Similar studies can be conducted at higher levels of education.

- This study was conducted on a small sample taken from one U.P. Board school. Similar studies on a larger sample taken from a number of U.P. Board School may be conducted.

- The duration for which retention was tested in this study was six weeks. Hence the present study is delimited to long term retention (Bacon and Stewart, 2006) of concepts. Studies involving very long term retention (Bacon and Stewart, 2006) of concepts can also be undertaken to explore the intervening effects on retention.

- Studies can be conducted on special learners such as the hearing impaired, the dumb, the mentally and physically challenged etc. It would require well elaborated pictorial and non-pictorial teaching aids. Such studies would establish the generalizability of the teaching strategy that is Multiple Intelligence Teaching Module.

- For finding out the effectiveness of the Multiple Intelligence Teaching Module on achievement of students, some studies with various other variables like socio-
economic status of the family, education of parents, creativity, interest, attitude and co-curricular achievement of students may be conducted.

- Studies comparing effectiveness of various teaching methods in various Government/ public schools affiliated to CBSE and/or ICSE and/or U.P. Board of Urban and/or rural settings are desirable for making wider generalizations.
- Studies on Multiple Intelligence Teaching Module by using it as an effective assessment tool for teachers or teacher educators can also be conducted.

5.17 Limitations of the study

Our conclusions and findings are subject to several limitations.

- The same instructor taught both sections in back-to-back classes. This raises the possibility of instructor fatigue as an issue that biases. The researcher had taken care of this to some extent by holding three days of each section in the first half of the day and three days in the second half.
- As Mathematics cannot be taught in isolation to the society, therefore it becomes mandatory to study the teaching of mathematics in context of the affective domain also. In this study only various aspects of the cognitive domain have been probed.
- The results should be applied cautiously to other settings since the demographics of students in this study may differ from students in other institutions. Future studies can examine whether the same results emerge under different settings.