# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapters</th>
<th>Title</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TITLE PAGE</td>
<td></td>
<td>i</td>
</tr>
<tr>
<td>DECLARATION BY STUDENT</td>
<td></td>
<td>ii</td>
</tr>
<tr>
<td>DECLARATION BY GUIDE</td>
<td></td>
<td>iii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENT</td>
<td></td>
<td>iv</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td></td>
<td>vi</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td></td>
<td>xiv</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td></td>
<td>xix</td>
</tr>
<tr>
<td>LIST OF THE ABBREVIATIONS</td>
<td></td>
<td>xx</td>
</tr>
</tbody>
</table>

## CHAPTER I: INTRODUCTION 1-25

| 1.0 | Introduction | 1 |
| 1.1 | Historical Review of Developments In Mathematics | 2 |
| 1.2 | Importance of Mathematics In Human Life | 6 |
| 1.3 | History of Teaching Methods | 9 |
| 1.4 | Methods of Teaching Mathematics | 11 |
| 1.5 | Aims of Teaching Mathematics | 15 |
| 1.6 | Innovative Practices in Mathematics Teaching | 16 |
| 1.7 | Present Status of Mathematics at Upper Primary Level | 17 |
| 1.8 | Statement of the Problem | 20 |
| 1.9 | Definitions of the Terms | 20 |
| 1.10 | Significance of the Study | 22 |
| 1.11 | Scope and Delimitations of the Study | 22 |
| 1.12 | Objectives of the Study | 23 |
1.13 Assumptions of the Study 23
1.14 Hypotheses of the Study 23
1.15 Organisation of the Study 24
1.16 Concluding Remark 25

CHAPTER II : REVIEW OF THE RELATED LITERATURE AND RESEARCHES 26-52
2.0 Introduction 26
2.1 Importance of Related Studies 26
2.2 Objectives of Review of Related Studies 27
2.3 Review of Work Done 28

2.3.1 Review of the Related Literature 28

2.3.1.1 Review of Related Literature from India 29
2.3.1.2 Review of the Related Literature from Abroad 34
2.3.1.3 Conclusions from Review of the Related Literature 37

2.3.2 Review of Related Researches 37

2.3.2.1 Review of Work Done Related to Instructional package on Mathematics 38
2.3.2.2 Conclusions From Studies Related to Instructional Package on Mathematics 42
2.3.2.3 Comparison of Studies Related to Instructional Package on Mathematics With Present Research 43
2.3.2.4 Review of Work Done Related to Development and Use of Self Instructional Material 44
2.3.2.5 Conclusions From Studies Related to Development and Use of Self Instructional Material 49
2.3.2.6 Comparison of Studies Related to Development and Use of Self Instructional Material With Present Research 50
2.4 General Conclusions from Review 51
2.5 Rationale for the Present Study 52
2.6 Concluding Remarks 52

CHAPTER III: PLAN AND PROCEDURE OF THE RESEARCH 53-133

3.0 Introduction 53
3.1 Research Method 53
  3.1.1 Flow Chart of Research 54
  3.1.2 Selection of Research Method 54
  3.1.3 Experiment 57
  3.1.4 Experimental Design 58
3.2 Research Design 62
3.3 Sampling Design And Sample Selection 63
  3.3.1 Sample Selection 65
  3.3.2 First Stage Population- School 66
  3.3.3 Second Stage Population- Class 66
  3.3.4 Third Stage Population- Students 66
3.4 Variables 67
  3.4.1 Dependent Variables 68
  3.4.2 Independent Variables 68
    3.4.2.1 Attribute Variables 68
  3.4.3 Confounding Variables 69
    3.4.3.1 Intervening Variables 69
    3.4.3.2 Extraneous Variables 69
3.5 Research Tools 70
  3.5.1 Mathematics Experiment Notebook (MEN) 70
3.5.1.1 Procedure for Developing Instructional Material 71
3.5.1.2 Instructional System Design 71
3.5.1.3 Instructional System Design Model 72
3.5.1.4 Developed Materials 79
3.5.1.5 Principles to be Considered While Developing Written Instructional Material 80
3.5.1.6 Basic Elements of Instructional Design 81
3.5.1.7 Steps Involved in the Preparation of Instructional Material 81
3.5.1.8 Objectives of Mathematics Experiment Notebook 83
3.5.1.9 Steps for Preparing the Mathematics Experiment Notebook 84
3.5.1.10 Investigators Thinking 85
3.5.1.11 Experienced School Teachers’ Opinion about the MEN 86
3.5.1.12 Research Experts Opinion about the MEN 89
3.5.1.13 Pilot Study 93
3.5.1.14 Sampling Used in Pilot Study 93
3.5.1.15 The Experiment Used in Pilot Study 94
3.5.1.16 Analysis and Interpretation of the Data Obtained in Pilot Study 94
3.5.1.17 Analysis and Interpretation of the Pre-Test Data of a Try-Out Sample (TOS) 94
3.5.1.18 Analysis and Interpretation of the Post-Test Data of a Try-Out Sample (TOS) 96
3.5.1.19 Analysis and Interpretation of the Pre Over Post-Test Data 98
3.5.1.20 Conclusions Regarding Pilot Study of the Prototype 100
3.5.1.21 Student’s Opinions about the MEN 100
3.6 Development of Mathematics Experiment Notebook 103
3.7 Establishing Stability 103
### 3.8 Validity of Mathematics Experiment Notebook

#### 3.8.1 Controls for Internal Validity

- **3.8.1.1 History**
- **3.8.1.2 Maturation**
- **3.8.1.3 Testing**
- **3.8.1.4 Instrumentation**
- **3.8.1.5 Regression**
- **3.8.1.6 Selection**
- **3.8.1.7 Mortality**
- **3.8.1.8 Interaction of Selection and Maturation**

#### 3.8.2 Controls for External Validity

- **3.8.2.1 Interaction of Testing and Treatment**
- **3.8.2.2 Interaction of Selection and Treatment**
- **3.8.2.3 Reactive Arrangements**
- **3.8.2.4 Multiple Treatment Interface**

### 3.9 Developed Mathematics Experiment Notebook

### 3.10 Implementation of Revised Mathematics Experiment Notebook

### 3.11 Questionnaire

### 3.12 Opinionnaire

### 3.13 Interview

### 3.14 Achievement Tests (Pre Test and Post Test)

### 3.15 Reliability and Validity of the Tools

#### 3.15.1 Validity and Reliability of the Questionnaire

#### 3.15.2 Validity and Reliability of the Opinionnaire

#### 3.15.3 Validity of the Interview
### CHAPTER IV: ANALYSIS AND INTERPRETATION OF DATA 134-217

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.0</td>
<td>Introduction</td>
<td>134</td>
</tr>
<tr>
<td>4.1</td>
<td>Survey of Present Position of Teaching Mathematics</td>
<td>134</td>
</tr>
<tr>
<td>4.2</td>
<td>Data Showing the Effectiveness of the Experiment</td>
<td>139</td>
</tr>
<tr>
<td>4.3</td>
<td>Analysis and Interpretation of the Data Obtained in Pre-Testing</td>
<td>139</td>
</tr>
<tr>
<td>4.3.1</td>
<td>Significance of Difference Between the Means from Both the Groups in the Pre-Test</td>
<td>139</td>
</tr>
<tr>
<td>4.3.2</td>
<td>Significance of Difference Between the SD’s from both the Groups in the Pre-Test</td>
<td>152</td>
</tr>
<tr>
<td>4.4</td>
<td>Analysis and Interpretation of the Data Obtained in Post-Testing</td>
<td>164</td>
</tr>
<tr>
<td>4.4.1</td>
<td>Significance of Difference Between the Means from both the Groups in the Post-Test</td>
<td>165</td>
</tr>
<tr>
<td>4.4.2</td>
<td>Significance of Difference Between the SD’s from Both the Groups in the Post-Test</td>
<td>178</td>
</tr>
<tr>
<td>4.5</td>
<td>Analysis and Interpretation of the Pre Over Post-Test Data</td>
<td>191</td>
</tr>
</tbody>
</table>
4.5.1 Significance of Difference Between the Pre and Post Test Marks for Both Groups

4.6 Comparison of achievement in MEN and conventional instructional system

4.7 Comparison of standard wise achievement in MEN and conventional instructional system

4.8 Comparison of object wise achievement in MEN and conventional instructional system

4.9 Concluding Remarks

CHAPTER V: SUMMARY, CONCLUSION, RECOMMENDATIONS AND SUGGESTIONS

5.0 Introduction

5.1 Need of the Study

5.2 Statement of the Problem

5.3 Definitions of the terms

5.4 Objectives of the Study

5.5 Hypotheses of the Study

5.6 Delimitations of the Study

5.7 Development and Research Procedure

5.7.1 Research Procedure (In Brief)

5.7.2 Experimental Design

5.7.3 Sampling Design

5.7.4 Sample Selection

5.7.5 Variables in the Experiment

5.7.6 Tools and Techniques

5.7.7 Analysis and Interpretation of Data
### 5.8 Chapter Wise Summary

### 5.9 Discussion of Result and Conclusions

#### 5.9.1 Conclusions based on the Questionnaire

#### 5.9.2 Conclusions Based on the Experienced School Teachers, Research Experts and Students Opinions about the MEN

#### 5.9.3 Conclusions based on the Pre-Test

#### 5.9.4 Conclusions Regarding Effects of MEN on Pupils Performance in the Post-Test

#### 5.9.5 Conclusions Regarding Effects on Pupils Performance in the Pre over Post-Test

### 5.10 Implications of the Study

### 5.11 Some Recommendations

### 5.12 Suggestions for Further Research

### REFERENCES - 248-253

### LIST OF APPENDICES - 254-255

### APPENDICES - 256-366