CONTENT

Chapter I – Conceptual Framework……..1
1.0 Introduction……1
1.1 Higher Order Thinking Skills…….2
1.2 Instructional Strategies to develop Higher Order Thinking Skills in Mathematics…...4
1.2.1 Strategies for the teaching phase……4
1.2.1.1 Cognitivist strategies to develop conceptual understanding of a concept…….5
1.2.1.2 Constructivist strategies to develop content-specific higher order thinking skills……7
1.2.2 Strategies for practice/exploration and assessment phase……11
1.2.3 Classroom environment for Mathematics teaching-learning……...12
1.3 Goals of Mathematics as Envisaged by the Indian Education System…….13
1.4 The Mathematical Unit of Numbering System: Real Numbers……...14
1.5 Need of the Study…….15
1.7 Objectives of the Study……17
1.8 Hypotheses of the Study……...18
1.9 Explanation of Key Terms……...19
1.10 Operational Definition of Key Terms ……..21
1.11 Scope and Limitations of the Study…….22
1.12 Organisation of the Report……...23
Chapter II – Review of Related Literature……..25
2.0 Introduction……..26
2.1 Studies that Reflect the Present Scenario of Mathematics Education……..26
2.1.1 Implication of the 'Studies that reflect the present scenario of Mathematics education' on the present Study…….31
2.2 Studies on Student-Characteristics Imperative for Higher Mathematical Achievements ……..32
2.2.1 Implication of the 'Studies on student characteristics for higher Mathematics achievement' on the present Study……..36
2.3 Studies on Effective Strategies for Enhancing Mathematics Achievement……38
2.3.1 Implication of the 'Studies on strategies to enhance Mathematics achievement' on the present Study……40
2.4 Studies on Strategies to Develop Different Mathematical and Higher Order Thinking Skills…….41

2.4.1 Implication of the 'Studies on strategies to develop different mathematical and higher order thinking skills' on the present Study……...49
2.5 Studies that Prove the Importance of Guided Instructions in Mathematics…….50
2.5.1 Implication of the 'Studies that prove the importance of guided instructions in Mathematics' on the present Study……..52
2.6 Studies on Teacher-related Difficulties in Using Effective Strategies in Mathematics Teaching……...53
2.6.1 Implications of the 'Studies on teacher-related difficulties in using effective strategies in teaching Mathematics' on the present Study……55
2.7 Studies Highlighting the Difficulties Involved in the Teaching and Learning of Real Numbers……...56
2.7.1 Implications of the 'Studies highlighting on the difficulties involved in the teaching and learning of Real Numbers' on the present Study……...58
2.8 Rationale of the Present Study…….60
Chapter III – Methodology…….....67
3.0 Introduction……..68
3.1 Development of Instructional Package…….68
3.1.1 Teaching strategies to be used for designing the Instructional Package……..69
3.1.2 Selection of content……..71
3.1.3 Original order of the topics in the GSHESB text books……..72
3.1.4 Re-sequenced structure of the topics for Instructional Package……...73
3.1.5 Design of lesson plans and worksheets……76
3.1.6 Modifications made in instructional package based on expert feedback…….76
3.2 Development of Achievement Tests……77
3.2.1 Purpose of the Achievement tests……79
3.2.2 Specification of concepts included in Achievement tests……79
3.2.3 Weightage to different cognitive level questions in the Achievement tests…….81
3.2.4 Preparation of blueprint for the Achievement tests……..81
3.2.5 Selection of item format for the Achievement tests…….82
3.2.6 Test length and duration……...82
3.2.7 Construction of test items in the Achievement tests……82
3.2.8 Evaluation of the Achievement Tests……..83
3.3 Development of Tools……84
3.3.1 Scoring Rubric to score achievement scores and cognitive competencies……..85

3.3.2 Development of the Reaction scale……..85
3.4 Initial Try-Out of Instructional Package……..86
3.4.1 Modifications incorporated in the Instructional package after the Initial try-out……86
3.5 Final Implementation of Instructional Package……87
3.5.1 Formation of equivalent groups……...87
3.6 Methodology adopted for the Study……91
3.6.1 Research design used in the Study……...91
3.6.2 Control to the threats of experimental validity for the present Study……..92
3.6.3 Stages of the experiment……..93
3.6.4 Variables of the Study……..94
3.6.5 Population of the Study……95
3.6.6 Sample of the Study……95
3.6.7 Procedure for data collection……95
3.7 Data Analysis Procedure used to check the Objective 3 and Reaction Scale……..95
3.7.1 Rationale for using the 't' test for Data Analysis……97
Chapter IV – Instructional Package…….....99
4.0 Introduction……100
4.1 Lesson Plan 1……101
4.2 Lesson Plan 2……104
4.3 Lesson Plan 3……109
4.4 Lesson Plan 4……112
4.5 Lesson Plan 5……115
4.6 Lesson Plan 6……118
4.7 Lesson Plan 7……121
4.8 Formative Assessment - Evaluation 1……124
4.9 Lesson Plan 8……126
4.10 Lesson Plan 9……130
4.11 Lesson Plan 10……...132
4.12 Lesson Plan 11……...135
4.13 Lesson Plan 12……...138
4.12 Lesson Plan 13……...143
4.13 Lesson Plan 14……...146
4.14 Lesson Plan 15……...149
4.17 Lesson Plan 18……...158

4.18 Formative Assessment - Evaluation 2……162
4.20 Lesson Plan 20……...167
4.21 Lesson Plan 21……...171
4.22 Lesson Plan 22……...174
4.23 Lesson Plan 23……...178
4.24 Lesson Plan 24……...183
4.25 Lesson Plan 25……...187
4.26 Lesson Plan 26……...189
Chapter V – Data Analysis and Interpretation……194
5.0 Introduction……195
5.1 Description of Analysis in Brief……195
5.2 Description of Analysis and Interpretation at Stage I……196
5.2.1 Analysis of the Posttest responses for competencies (sub-objectives 3.1 and 3.2)…197
5.2.1.1 Question-wise analysis of the Posttest responses for competencies……..198
5.2.1.2 Interpretation of the Posttest responses for Higher level competencies…….230
5.2.2 Analysis and interpretation of Posttest responses for achievement (sub-objectives 3.3 and 3.4)……...233
5.2.2.1 Analysis and interpretation of achievement scores with respect to the cognitive levels ……234
5.2.2.2 Analysis and interpretation based on overall achievement scores……235
5.3 Description of Analysis and Interpretation of Reaction Scale in Stage II……..235
5.3.1 Analysis and interpretation of students' reaction on the instructional strategies implemented in the classroom……237
5.3.2 Analysis and interpretation of students' reaction on their understanding on different concepts and processes of the unit 'Real Numbers'……...238
5.3.3 Analysis and interpretation of students' reaction on their feelings/perceptions towards the unit 'Real Numbers' and towards the subject of Mathematics…….239
5.3.4 Analysis and interpretation of students' reaction on the worksheets solved during the intervention period……..240
5.3.5 Analysis and interpretation of students' reaction on the formative assessments-Evaluation1 and Evaluation 2…….241
5.3.6 Analysis and interpretation of students' reaction on the overall Instructional Package and its implementation……...242
5.4 Findings of the Study…….243

5.4.1 Findings from the analysis of higher level competencies……..243
5.4.2 Findings from the analysis basic level competencies……244
5.4.3 Findings from the analysis of the t-test result of the Posttest at individual cognitive levels of -Comprehension, Application, Analysis, Synthesis and Evaluation……...244
5.4.4 Findings from the analysis of the t-test result of the achievement scores of the Posttest at all cognitive levels……..245
5.4.5 Findings from the analysis of the Reaction scale……...246
Chapter VI – Summary, Major Findings, Discussion, Suggestions……248
6.0 Introduction……249
6.1 Rationale of the Present Study……...250
6.2 Statement of the Problem……...251
6.3 Objectives and Hypotheses of the Study……251
6.4 Explanation and Operationalization of Terms……253
6.5 Methodology of the Study……..256
6.6 Data Analysis Procedure……257
6.7 Major Findings of the Study……...257
6.8 Researcher's Observations during the Implementation of the Instructional Package ……261
6.9 Discussion……..265
6.10 Suggestions……268
6.10.1 Suggestions for Mathematics teachers……...268
6.10.2 Suggestions for policy makers……...269
6.10.3 Suggestions for further research……271
6.11 Conclusion……..271
References……273