FACTORS INFLUENCING YEAR 9 STUDENTS’ MATHEMATICS PERFORMANCE RELATED TO LOWER ORDER THINKING (LOT) AND HIGHER ORDER THINKING (HOT) IN ACEH, INDONESIA: A MULTIVARIATE AND MULTILEVEL ANALYSIS

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Table of Content

Table of Content............................................................................................................ i
List of Tables .................................................................................................................... iv
List of Figures ................................................................................................................... ix
Abstract ............................................................................................................................ xi
Declaration ......................................................................................................................... xiii
Acknowledgements ......................................................................................................... xiv

Chapter 1 Introduction ........................................................................................................ 1
  1.1. Background of the Study .......................................................................................... 1
  1.2. Statement of the Research Problem .......................................................................... 12
  1.3. Research Questions ................................................................................................ 14
  1.4. Structure of the Thesis ............................................................................................ 15
  1.5. Summary .................................................................................................................. 17

Chapter 2 Review of Research Studies ................................................................................ 19
  2.1 Introduction ................................................................................................................ 19
  2.2 Lower Order Thinking (LOT) and Higher Order Thinking (HOT) ......................... 20
  2.3 Educational Effectiveness Theory and the Dynamic Model ..................................... 32
  2.4 Factors Affecting Students’ Mathematics Performance .......................................... 36
  2.5 Conceptual Framework ............................................................................................ 47
  2.6 Summary .................................................................................................................. 50

Chapter 3 Methods of Investigation ................................................................................... 51
  3.1 Introduction ................................................................................................................ 51
  3.2 Methods Employed in this Study ............................................................................. 51
  3.3 Ethics Approval ......................................................................................................... 52
  3.4 Sampling and Data Collection .................................................................................. 52
  3.5 The Questionnaires .................................................................................................. 54
  3.6 Operationalisation and Measurement ....................................................................... 56
  3.7 The Pilot Study ......................................................................................................... 65
  3.8 General Methodological Considerations ................................................................... 68
  3.9 Statistical Procedure Employed in this Study ............................................................. 73
  3.10 Validity and Reliability of Instruments ................................................................... 88
  3.11 Summary .................................................................................................................. 90

Chapter 4 Research Instruments: Students ......................................................................... 93
  4.1 Introduction ................................................................................................................ 93
4.2 Confirmatory Factor Analysis (CFA) .................................................. 94
4.3 Rasch Analysis ................................................................................. 96
4.4 Student Attitudes towards Mathematics (SAM) Instrument .......... 97
4.5 The Student Self-efficacy towards Mathematics (SSM) Instrument .. 104
4.6 The Student Beliefs towards Mathematics (SBM) Instrument .......... 110
4.7 Student Learning Activities (SLA) Instrument .............................. 115
4.8 Summary ......................................................................................... 119

Chapter 5 Research Instruments: Teacher ...................................... 121
5.1 Introduction ..................................................................................... 121
5.2 Teacher Beliefs concerning Mathematics (TBM) Instrument ...... 121
5.3 Instructional Activities for Students (IAS) Instrument ............... 134
5.4 Teacher Engaging Student (TES) Instrument ............................. 137
5.5 Summary ......................................................................................... 140

Chapter 6 Descriptive Analysis and Contextual Information .......... 142
6.1 Introduction ..................................................................................... 142
6.2 School Demographic Information ................................................. 142
6.3 Teachers’ Information ..................................................................... 147
6.4 Students’ Information ..................................................................... 158
6.5 Summary ......................................................................................... 175

Chapter 7 Single-Level Path Analysis: Student-Level ................ 178
7.1 Introduction ..................................................................................... 178
7.2 Model Building in the PLS-PA ...................................................... 178
7.3 Measurement Model (Outer Model) ............................................. 183
7.4 Structural (Inner) Model ............................................................... 189
7.5 Summary ......................................................................................... 201

Chapter 8 Single-Level Path Analysis: Teacher-level ................ 205
8.1 Introduction ..................................................................................... 205
8.2 Model Building of PLS-PA ............................................................ 206
8.3 Measurement Model (Outer Model) ............................................. 211
8.4 Structural Model (Inner Model) .................................................... 214
8.5 Summary ......................................................................................... 219

Chapter 9 Hierarchical Linear Modelling Analysis: Student Mathematics Performance 221
9.1 Introduction ..................................................................................... 221
9.2 The Variables and their Level of Operation ............................... 223
9.3 Formulating and Testing Three-level Models.................................................. 226
9.4 HLM Findings for Mathematics Performance as the Outcomes Variables 227
9.5 Summary ........................................................................................................... 241

Chapter 10 Discussion and Conclusion ................................................................. 244

10.1 Introduction ..................................................................................................... 244
10.2 Discussion of Findings .................................................................................. 246
10.3 Implications of the Study ............................................................................. 261
10.4 Limitations of the Study and Recommendations for Future Research ..... 267
10.5 Concluding remarks ..................................................................................... 268

Appendices ............................................................................................................. 269

Appendix A Ethics Approval from the University of Adelaide ......................... 270
Appendix B Ethics Approval from the Indonesian government ....................... 272
Appendix C School Questionnaire .................................................................... 280
Appendix D Teacher questionnaire .................................................................... 284
Appendix E Student questionnaire ..................................................................... 292
Appendix F Mathematics test ............................................................................. 302
Appendix G Mathematics Test and Marking Scheme Format ......................... 306
Appendix H Model Fit Indices ........................................................................... 315
Appendix I Independent t-test Results .............................................................. 318

References .............................................................................................................. 323
List of Tables

Table 3.1 Distribution of the Sample according to Location ........................................... 53
Table 3.2 Development of Items of School Questionnaire and Expressions Used in School Measurement Scales ................................................................................................. 57
Table 3.3 Development of Items of Teacher Questionnaire and Expressions Used in Teacher Measurement Scales ............................................................................................... 60
Table 3.4 Development of Items of Student Questionnaire and Expressions Used in the Student Measurement Scales ......................................................................................... 64
Table 3.5 Guidelines of Evaluating PLS Path Models (Hair, Sarstedt, et al., 2012) ................................ 85
Table 4.1 Summary of Model Fit Indices, Acceptable Range and Interpretation (Schumacker & Lomax, 2012, p.76) ............................................................................................. 96
Table 4.2 Student Attitudes towards Mathematics (SAM) Instrument Subscales ..... 97
Table 4.3 Factor Loadings of Items, Average Variance Extracted (AVE) and Composite Reliability (CR) of Single-factor Model and Two-factor Models of SAM ........................................................................................................ 102
Table 4.4 Summary of Model Fit Indices for Single-factor Model and Two-factor Models of SAM ............................................................................................................................................... 102
Table 4.5 Response Model Parameter Estimates of Two-correlated Factor Model of SAM ................................................................................................................................................ 103
Table 4.6 Student Self-efficacy towards Mathematics (SSM) Instrument Subscales ............................................................................................................................................... 105
Table 4.7 Factor Loadings of Items, Average Variance Extracted (AVE) and Composite Reliability (CR) Values of Single-factor Model and Two-factor Models of SSM ........................................................................................................................................ 108
Table 4.8 The Summary of Model Fit Indices for Single-factor Model and Two-factor Models SSM ............................................................................................................................................... 108
Table 4.9 Item Response Parameter Estimates of the Two-correlated Factor Models of Student Self-efficacy towards Mathematics (SSM) ........................................................................ 109
Table 4.10 Student Beliefs towards Mathematics (SBM) Instrument Subscales ..... 111
Table 4.11 Factor Loadings of Items, Average Variance Extracted (AVE) and Composite Reliability (CR) of Single-factor Model, Two-factor Model of SBM ........................................................................................................ 113
Table 4.12 Summary of Model Fit Indices for Single-factor Model, Two-factor and Three Factor Models of SBM ................................................................. 113
Table 4.13 Response Model Parameter Estimates of SBM_LOT ........................................ 114
Table 4.14 Response Model Parameter Estimates of SBM_HOT ......................................... 114
Table 4.15 Student Learning Activities (SLA) Instrument Subscales ................................. 115
Table 4.16 Factor Loading of Items, Average Variance Extracted (AVE) and Composite Reliability (CR) of the Single-factor Model and Two-factor Models of SLA ........................................................................... 117
Table 4.17 Summary of Model Fit Indices for the Single-factor Model and Two-factor Models of SLA ........................................................................... 117
Table 4.18 Response Model Parameter Estimates of Rating Scale of the Two-correlated Factors Model of SLA ............................................................... 118
Table 5.1 Teachers’ Beliefs concerning Mathematics (TBM) Instrument Subscales .......... 123
Table 5.2 Factor Loadings, Average of Variance Extracted (AVE) and Composite Reliability (CR) of Items of Single-factor Model, Separate Models, Four-factor Models, and Six-factor Models of TBM ........................................... 128
Table 5.3 Summary of Model Fit Indices for Single-factor Model, Separate Models, Four-factor Models, and Six-factor Models of TBM ........................................... 129
Table 5.4 Response Model Parameter Estimates of Two-correlated Factors Model of TBM LOT ......................................................................................... 130
Table 5.5 Response Model Parameter Estimates of Two-correlated Factors Model of TBM HOT ......................................................................................... 131
Table 5.6 Response Model Parameter Estimates of Teacher Beliefs concerning Nature of Mathematics and Mathematics Learning related to LOT (TBNMML LOT) ........................................................................... 132
Table 5.7 Response Model Parameter Estimates of Teacher Beliefs concerning Mathematics Teaching related to LOT (TBMT LOT) ................................. 132
Table 5.8 Response Model Parameter Estimates of Teacher Beliefs concerning Nature of Mathematics and Mathematics Learning related to HOT (TBNMML HOT) ........................................................................... 132
Table 5.9 Response Model Parameter Estimates of Teacher Beliefs concerning Mathematics Teaching related to HOT (TBMT HOT) ................................. 133
Table 5.10 Instructional Activities Approach for Students (IAS) Instrument ................ 134
Table 5.11 Factor Loading of Items, Average Variance Extracted (AVE) and Composite Reliability (CR) of Single-factor Model of IAS ............. 135
Table 5.12 Summary of Fit Indices for Single-factor Model with 10 Items and 7 Items of IAS .................................................................................. 136
Table 5.13 Response Model Parameter Estimates of IAS Instrument for 7 Items of IAS ............................................................................................................. 137
Table 5.14 Teacher Engaging Student (TES) Instrument ......................... 138
Table 5.15 Loadings of items, Average Variance Extracted (AVE), and Composite Reliability (CR) of Single-factor Model of TES............... 139
Table 5.16 Summary of Fit Indices for Single-factor Model of TES .............. 139
Table 5.17 Response Model Parameter Estimates of TES.................................. 139
Table 6.1 Types of Schools Involved in the Study (N=25) ............................. 143
Table 6.2 Total Enrolment in Schools (N=25) ........................................... 143
Table 6.3 School Admission Criteria (N=25) ............................................. 144
Table 6.4 Characteristics of the Teachers in Schools (N=25) ...................... 145
Table 6.5 Schools Having Specific Teaching and Learning Resources (N=25) .... 146
Table 6.6 Additional Mathematics Programme at Schools (N=25) ............... 147
Table 6.7 Teachers’ Gender and Years of Teaching (N=46) ...................... 148
Table 6.8 Teachers’ Education and Major (N=46) ................................... 149
Table 6.9 Regularity of Attending Professional Development Programme for Mathematics Teachers (N=46) ............................................................. 149
Table 6.10 Teachers’ Professional Development (N=46)............................ 150
Table 6.11 Teachers’ Certification (N=46)................................................. 150
Table 6.12 Index of Teacher Beliefs concerning Mathematics related to LOT (N=46) .............................................................................................................. 151
Table 6.13 Index of Teacher Beliefs concerning Mathematics related to HOT (N=46) ............................................................................................................. 152
Table 6.14 Regularity of Types of Questions used in Mathematics Classroom .... 154
Table 6.15 Regularity of Types Questions used in Mathematics Examination ...... 154
Table 6.16 Instructional Approaches used for Students in the Mathematics Classroom ........................................................................................................ 155
Table 6.17 Engaging Students (N=46) ....................................................... 156
Table 6.18 Gender and School Location (N=1135) ..................................... 158
Table 6.19 Mothers’ and Fathers’ Highest Level of Education .................... 159
Table 6.20 Mother’s Educational Level and School Location (N=1116) ................................................. 160
Table 6.21 Fathers’ Educational Level and School Location (N=1077) .................. 160
Table 6.22 Second Category of Students’ Home Possessions and School Location (N=1135) ................................................................. 163
Table 6.23 Students’ Educational Expectations (N=1114) .......................................................... 164
Table 6.24 Students’ Educational Expectation across School Location (N=1135) . .. 165
Table 6.25 Students’ Liking of Mathematics (N=1134) ............................................................... 166
Table 6.26 Students’ Valuing Mathematics (N=1135) ................................................................. 167
Table 6.27 Students’ Confidence in Mathematics (N=1135) ....................................................... 168
Table 6.28 Students’ Individual Judgement of Mathematics Ability (N=1132).... 168
Table 6.29 Students’ Beliefs concerning Mathematics related to LOT (N=1132). . 169
Table 6.30 Students’ Beliefs concerning Mathematics related to HOT (N=1134) .. 170
Table 6.31 Types of Questions in Mathematics Classroom........................................ 171
Table 6.32 Students’ Engagement related to LOT (N=1120) ......................................................... 173
Table 6.33 Students’ Engagement with the Learning Activities related to HOT (N=1110) ........................................................................................................................... 173
Table 6.34 Student Mathematics Performance related to LOT (N=1135)......... 174
Table 6.35 Student Mathematics Performance related to HOT (N=1135) ....... 175
Table 7.1 Variables at Student-level Model .............................................................. 180
Table 7.2 Relationship between Correlations among Constructs and Square Root of AVEs (Fornell-Larcker Criterion) for Discriminant Validity .......................... 185
Table 7.3 Result Summary for Reflective Measurement (Outer) Model ........... 186
Table 7.4 Outer Weights, Outer Loading Significance and Collinearity Testing Results for Formative Measurement Model ......................................................... 188
Table 7.5 Summary of Results of Structural (Inner) Model .............................. 191
Table 8.1 Variables at Teacher-level Model .......................................................... 208
Table 8.2 Result Summary for Reflective Measurement (Outer) Model ........ 211
Table 8.3 Relationship between Correlations among Constructs and Square Root of AVEs (Fornell-Larcker Criterion) ................................................................. 212
Table 8.4Outer Weights and Loading Significance Testing Results for Formative Measurement (Outer) Model ................................................................. 214
Table 8.5 Summary of Results of Structural (Inner) Model .............................. 215
Table 9.1 Observed Variables in Hierarchical Linear Modelling Analyses with Mathematics Performance as the Outcome ......................................................... 224
Table 9.2 Fully Conditional Model of Mathematics Performance related to LOT.. 229
Table 9.3 Final Model of Students’ Mathematics Performance related to LOT...... 232
Table 9.4 Estimation of Variance Component and Explained Variance for
Mathematics Achievement related to LOT ............................................ 233
Table 9.5 Fully Unconditional Model of Mathematics Achievement related to HOT
                                                                                       .......................................................... 235
Table 9.6 Final Model of Students’ Mathematics Performance related to HOT .... 239
Table 9.7 Estimation of Variance Component and Explained Variance for
Mathematics Performance related to HOT............................................ 240
List of Figures

Figure 2.1 Simplified diagram of educational effectiveness ........................................ 35
Figure 2.2 Conceptual framework of factors influencing students’ mathematics performance related to LOT and HOT .............................................................. 49
Figure 4.1 Single-factor model and two-orthogonal factors model of SAM .......... 99
Figure 4.2 Two-correlated factors model and two-correlated factors model of SAM with two-correlated errors (residual terms) ........................................ 99
Figure 4.3 Two-hierarchical factors model and two-hierarchical factors model of SAM with two-correlated errors (residual terms) .............................. 100
Figure 4.4 Single-factor model and two-orthogonal factors model of SSM ...... 106
Figure 4.5 Two-correlated factors model and two-correlated factors model with errors correlated of SSM ................................................................. 106
Figure 4.6 Two-hierarchical factors model and two-hierarchical factors model with errors correlated of SSM ............................................................... 107
Figure 4.7 Single-factor and two-orthogonal factors models of SBM ............ 112
Figure 4.8 Single-factor model and two-orthogonal factors models of SLA .... 116
Figure 4.9 Two-correlated factors and two-hierarchical factors models of SLA ... 116
Figure 5.1 Single-factor model of TBM ................................................................. 125
Figure 5.2 Six-orthogonal factors model and four-orthogonal factors model of TBM ...................................................................................................... 126
Figure 5.3 Separate model: two-orthogonal factors model and two-correlated models of TBM related to LOT ................................................................. 127
Figure 5.4 Separate model: two-orthogonal and two-correlated factors models of TBM related to HOT (TBNM_D is excluded) ................................. 127
Figure 5.5 Single-factor model with 10 items and 7 items of the IAS .......... 135
Figure 5.6 Single-factor model of TES ................................................................. 138
Figure 6.1 Schools class size distribution (N=25) ............................................. 144
Figure 6.2 Class classification methods within schools (N=25) ..................... 145
Figure 6.3 Percentage of teaching resources used in mathematics classroom (N=46) ................................................................................................. 158
Figure 6.4 Number of students who live in a home and the first category of home possessions (N=1135) ................................................................. 161
Figure 6.5 Number students who have the second category of home possessions (N=1135) ........................................................................................................ 162
Figure 6.6 First category of home possessions across school location (N=1135) ... 163
Figure 6.7 Learning resources used in mathematics classroom (N=1135) .......... 171
Figure 7.1 Hypothesised model for student-level model (N=1135) ............... 181
Figure 7.2 Final model for student-level model (N=1135) ............................ 182
Figure 8.1 Hypothesised model for teacher-level model (N = 46) ............... 209
Figure 8.2 Final model for teacher-level model (N = 46) ............................ 210
Figure 9.1 Conceptual Three-level model of mathematics performance related to LOT ........................................................................................................... 225
Figure 9.2 Conceptual Three-level model of mathematics performance related to HOT ............................................................................................................ 225
Figure 9.3 Final three-level HLM model for mathematics achievement related to LOT ............................................................................................................ 233
Figure 9.4 Final three-level HLM model for mathematics performance related to HOT ............................................................................................................ 240
Abstract

This study examines various factors associated with students’ mathematics performance, specifically in relation to higher order thinking (HOT) and lower order thinking (LOT). It examines the student-, teacher- and school-level factors, their interrelationships and impact on Year 9 students’ mathematics performance in Aceh, Indonesia.

The theoretical basis of this study comes from research on childhood cognitive development and educational theory, educational effectiveness theory, and a review of numerous previous studies related to how variables at student-, teacher- and school-level contribute to students’ mathematics performance. The conceptual framework is a multilevel analysis of the factors influencing students’ performance related to LOT and HOT designed to examine the possible relationships within and between student-, teacher- and school-level variables. Student-level variables include students’ background, attitudes and beliefs, as well as classroom practices as perceived by students. Teacher-level variables include teachers’ background, beliefs, and classroom practices as perceived by teachers. School-level variables include school demographics information and resources.

The study employs a quantitative method. Questionnaires and a mathematics test were used to obtain data from students, teachers and schools. Questionnaires were given to students, mathematics teachers and principals/administrators at the schools and a mathematics test administered to the students. The questionnaires were administered to a total of 1135 Year 9 students, 46 Year 9 mathematics teachers and 25 schools from one major city (representing the urban area) and one district (representing the rural area) in the province of Aceh, Indonesia. Scales in the questionnaires were validated using confirmatory factor analysis (CFA) and Rasch analysis. The data was then analysed employing single-level and multilevel analysis techniques. Partial least squares path analysis (PLS-PA) and hierarchical linear modelling (HLM) were employed to examine the relationships between variables tested in this study.

The results from the single-level analysis using PLS-PA show that there are five variables directly influencing students’ mathematics performance relating to LOT: (a) students’ beliefs concerning mathematics related to LOT; (b) gender; (c) school location; (d) socio-economic status (SES); and (e) students’ attitude of liking
mathematics. The multilevel analysis using HLM indicates that there are seven variables (three at student-level, three at teacher-level and one at school-level) that have a direct impact on the students’ mathematics performance related to LOT: (a) students’ liking of mathematics; (b) students’ beliefs concerning mathematics related to LOT; (c) students’ beliefs concerning mathematics related to HOT; (d) teachers’ professional development; (e) instructional activities; (f) teachers’ beliefs concerning mathematics related to HOT; and (g) school resources.

The results from the single-level analysis using PLS-PA indicate that four variables directly influence students’ mathematics performance related to HOT, namely: (a) students’ mathematics performance related to LOT; (b) students’ educational expectations; (c) SES; and (d) school location. The multilevel analysis using HLM indicates seven variables (four at student-level, two at teacher-level and one at school-level) that directly influence student mathematics performance related to HOT, namely: (a) students’ mathematics performance related to LOT; (b) students’ educational expectations; (c) students’ individual judgement of mathematics ability; (d) students’ beliefs concerning mathematics related to LOT; (e) teacher certification; (f) teachers’ beliefs concerning mathematics teaching related to HOT; and (g) the availability of a ‘Mathematics Olympiad’ club at the schools.

This study contributes to the literature of how student-, teacher- and school-level variables influence students’ mathematics performance related to LOT and HOT, especially in the context of Aceh, Indonesia, a developing nation. This study also provides empirical evidence of Acehnese students’ mathematics performance related to LOT and HOT, indicating their poor performance in questions related to both LOT and HOT. While students throughout the world struggle with mathematics problems that require HOT, in Aceh, and Indonesia in general, students are still struggling with LOT. This is clearly a subject of a great concern for the development of mathematics education in Aceh and Indonesia. As the current trends in education have shifted from lower order to higher order thinking, Indonesia as a rapidly developing nation needs to meet the challenge of progressing the nation’s education. Thus, the findings of this study have important implications for the improvement of mathematics teaching and learning in Aceh, Indonesia. Mathematics teaching and learning that improve both lower order thinking and higher order thinking skills should be of major concern for Indonesia and the efficient mathematics education of its students.
Declaration

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

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Date:  6th November 2017
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