

**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**

Elizar

B.Ed (Mathematics Education) (Syiah Kuala University)

M.Ed (MT) (The University of Adelaide)

This thesis is submitted in fulfilment of the requirements for
the degree of Doctor of Philosophy

School of Education, Faculty of Arts
University of Adelaide
November 2017

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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

Acknowledgements

This study would not have been possible without the assistance of many individuals, organisation and schools. I would like to express my deepest gratitude and appreciation to them all.

- The Australian Awards Scholarship (AAS) programme for the full scholarship and support during my study.
- My principal supervisor, Dr I Gusti Ngurah Darmawan, for his guidance and encouragement during my study. His ongoing support does not only make the completion of this thesis possible but also inspires me to be an independent researcher and a lifelong learner.
- My co supervisor, Dr Peggy Lynch, for her time reading my draft despite being away in Ireland.
- Professor John Keeves, for his commitment and enthusiasm in reading my drafts and his constructive feedback on each chapter of this thesis.
- My best friend and ‘personal editor’, Wendy Baker, for her assistance to read each initial draft of the chapters in this thesis and for her endless support during my highs and lows.
- The 25 schools in the province of Aceh, their teachers and their students for their time participating in my study.
- My late parents who allowed me to go far away for study despite their struggle of missing me each day, without their sincere prayers for my success I would not have come this far. It is very sad that I cannot tell them in person that I have completed my study but I will make sure that they are always in my prayers.
- My siblings, nephews and nieces for making me look forward to coming home.
- My beloved friends: Che Yee, Michelle and Alex for the wonderful ‘quantitative group’ support system, for the great discussion on our research methods and for the great times we had; Patrick and Giang, for the jokes and laughs we shared each day that make this PhD journey more bearable; Rachel for best companion during my revision days; and Safira for being there for me each time I need.
- All my colleagues and the staff of the school of Education at the University of Adelaide for their support during my study.