Faculty of Cognitive Sciences and Human Development

EFFECTS OF MODIFYING ENGLISH LANGUAGE FEATURES ON PRIMARY SCHOOL STUDENTS' MATHEMATICS PERFORMANCE: AN EXPERIMENTAL STUDY.

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11th May, 2009

(Date submitted)

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EFFECTS OF MODIFYING ENGLISH LANGUAGE FEATURES ON PRIMARY SCHOOL STUDENTS' MATHEMATICS PERFORMANCE: AN EXPERIMENTAL STUDY.

CHARLES CHENG WUEN KING

This project is submitted in partial fulfilment of the requirements for a
Bachelor of Education with Honours
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The project entitled 'Effects Of Modifying English Language Features On Primary School Students' Mathematics Performance: An Experimental Study" was prepared by Charles Cheng Wuen King and submitted to the Faculty of Cognitive Sciences and Human Development in partial fulfillment of the requirements for a Bachelor of Education with Honours (Teaching English as Second Language).

It is hereby confirmed that the student has done all necessary amendments of the project for acceptance:

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ABSTRACT

This study investigated the effects of modifying English language features of Mathematics test items among 163 Primary Five students of an urban school in Sibu town, Sarawak. Apart from that, the study also investigated the effects of linguistics modification on students' performance across different English and Mathematics abilities. A Mathematics test of 20 items was constructed using 10 linguistically complex items taken from UPSR past papers; the items were modified based on the 13 indices of linguistic complexities proposed by Abedi, Lord and Plummer (1997), and Abedi, Lord and Hofstetter (1998). Contrary to the findings of Abedi et al. (1997, 1998) and Isha (in press), results obtained from the present study revealed that linguistic modifications did not improve participants' performance, while a slight but insignificant decline of performance was recorded. Across different Mathematics abilities, participants categorized as "Below Average" did significantly worse in the accommodated set of items; across different English abilities, participants categorized as "Average" and "Below Average" did significantly worse in the accommodated set of items. Furthermore, participants only improved on 3 pairs of questions and did worse on 6 other pairs of questions. Analyses of the different levels of performance by different level of abilities in the experimental test provide invaluable insights into the effects of linguistic modifications on ESL learners' performance in Mathematics.

ABSTRAK

Kajian ini bertujuan untuk menentukan kesan pengubahan struktur Bahasa Inggeris dalam ujian Matematik sekolah rendah ke atas sebanyak 163 pelajar Darjah 5 di sebuah sekolah rendah di Bandar Sibu, Sarawak. Selain itu, kajian ini juga mengkaji kesan pengubahan struktur bahasa ke atas ujian Matematik di kalangan variasi pencapaian pelajar dalam Bahasa Inggeris dan subjek Matematik di sekolah. Instrumen kajian ini adalah satu set ujian Matematik yang mengandungi 20 soalan Matematik dan telah diolah berdasarkan 10 soalan Matematik UPSR yang mempunyai struktur bahasa yang mengelirukan; pengubahan struktur ayat dijalankan ke atas 10 soalan tersebut berdasarkan 13 indeks struktur bahasa yang mengelirukan hasil kajian Abedi, Lord dan Plummer (1997) serta Abedi, Lord dan Hofstetter (1998). Bertentangan dengan hasil eskperimen yang dijalankan oleh Abedi et al. (1997, 1998) dan Isha (in press), kajian ini mendapati pengubahan struktur bahasa ke atas soalan Matematik bukan sahaja tidak berkesan meningkatkan pencapaian responden dalam set soalan diubah, malah sampel responden memperlihat penurunan yang sedikit tetapi tidak signifikan. Melalui perspektif variasi pencapaian pelajar dalan subjek Matematik, kajian ini mendapati pencapaian oleh pelajar yang dikategorikan sebagai pelajar "Bawah Sederhana" dalam subjek Matematik telah menurun secara signifikan. Selain itu, pencapaian pelajar yang dikategorikan sebagai "Sederhana" dan "Bawah Sederhana" dalam subjek Bahasa Inggeris di sekolah telah menurun secara signifikan. Dalam 9 pasangan soalan yang diuji, sampel responden Cuma memperlihat peningkatan dalam 3 pasangan dan penurunan dalam 6 pasangan. Kelangsungan daripada hasil kajian ini mendorong kepada analisis yang lebih mendalam terhadap kesan pengubahan struktur bahasa ke atas pencapaian pelajar dalam subjek Matematik.

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LIST OF ABBREVIATION

APA	American Psychological Association
AERA	American Education Research Association
AV	Average
BA	Below Average
BICS	Basic Interpersonal Communicative Skills
CALP	Cognitive Academic Language Proficiency
CRESST	National Center for Research on Evaluation, Standards, and Student Testing
ELLs	English language learners
ESL	English a Second Language
ETeMS	English Teaching of Mathematics and Science
GD	Good
i^2	Index of improvement
MOI	Medium of instruction
MYR	Malaysian Ringgit
NAEP	National Assessment of Educational Progress
NCME	National Council on Measurement in Education
NGO	Nongovernmental organization
PMR	Penilaian Menengah Rendah (Lowe Secondary Assessment)
SPM	Sijil Pelajaran Malaysia (Malaysian Education Certificate)

SPSS	Statistics Package for Social Studies (software)
STPM	Sijil Tinggi Persekolahan Malaysia (Malaysian Higher School Certificate)
UNESCO	United Nations Educational, Scientific and Cultural Organization
UPSR	Ujian Penilaian Sekolah Rendah (Primary School Evaluation Test)

CHAPTER 1

INTRODUCTION

1.0 CHAPTER OVERVIEW

This chapter provides a review of the current policy of teaching of Mathematics and Science in English (hereafter, ETeMS) in the national primary and secondary syllabus in Malaysia, as well as the teaching and learning problems faced by teachers, learners and schools in regard of the policy for the past 6 years. In addition, this chapter looks at the paucity of research conducted on the steps taken to address the problems as identified in past studies and then culminates with the discussion on the need to provide a stopgap measure to address the linguistic difficulties faced by learners when assessed in Mathematics using English.

1.1 Background of study

The Malaysian government implemented the ETeMS policy in year 2003 to replace Bahasa Malaysia as the medium of instruction for Science and Mathematics subjects. The reasons for this change were to arrest Malaysian learners' declining English standard as well as to improve Malaysian education system's competitiveness and quality. Under the new policy, Science and Mathematics subjects in national level standardized examination such as PMR and SPM are assessed in both Bahasa Malaysia and English languages. This decision

was a stark contrast to the 1970 policy when Bahasa Malaysia (or Malay language) and learners' native languages (such as Mandarin or Tamil) were the only allowed medium of instruction and testing.

Although there are studies that investigate opinions and difficulties faced by the policy's stakeholders, there is still a dearth of Malaysian-context research into actual solutions to the policy stakeholders' difficulties. This study hopes to examine and offer feasible solutions to assist learners to absorb the impact of transition from learners' first language to English in learning and testing of Science and Mathematics.

1.2 Statement of Problem

Most of the past studies conducted into finding out the educational stakeholders' view of the policy of ETeMS unanimously agreed that such policy has brought both positive and negative impacts upon teachers' and learners' motivation to teach and learn Mathematics and Science using a language that is mostly alien and foreign to most people. Noordin (2007) stated while Mathematics is an interesting subject to learn, the fact that learners low English language proficiency and frustration with their failed attempts to link what they know in their first language to what is being taught using English is often the source of learners' low achievement in both English and Mathematics. Haron, Gapor, Masran, Ibrahim and Mohamed Nor (2008) reported that a large majority of learners irrespective of their location in either rural or urban areas have troubles understanding instructions of Mathematics in English. Haron et al. (2008) further suggested that learner's poor English competency often hinder them from expressing their true Mathematics ability, as most Malaysians learners do not use English as their first language.

Teachers too expressed the same frustrations as they are not only forced to accept the sudden transition after teaching the subjects for years, they have to spend a considerable amount of time and energy to increase their English proficiency and quality of instructions. Undertaking such efforts can be very taxing in addition to countless responsibilities tasked to teachers. Pillay (2003)

noted that the ETeMS policy has placed huge strains on test markers who need to possess competencies in both English and another native language commonly used during assessment of national level examination scripts.

1.3 Aims and Objectives of the Study

The present study is primarily concerned with linguistic solutions that Malaysian ESL learners can use to cope with unnecessary linguistic load in national level Science and Mathematics examination papers. This concern's validity is vested firmly in the fact that a huge majority of Malaysian learners are non native English speakers and a large part of these learners' future depend heavily on how well they fare in critical subjects in national examinations. Several federally funded studies into the inclusion of limited ESL (English as Second Language) learners in Mathematics assessments in the United States have shown that unnecessary linguistic load can interfere with the assessments' original aim. Noordin (2007) exhibited that learners' English proficiency affects learners' Mathematics score, expounding the call by the American Psychological Association (APA), the American Education Research Association (AERA) and National Council on Measurement in Education (NCME) in 1999 to take into consideration test-takers' lingustics ability in designing fair assessments.

This study is aimed at investigating the effects of linguistic modifications in Mathematics' test items on ESL learners' Mathematics performance. In relation to this, the following research questions are proposed:

1 a) Do linguistic modifications to Mathematics items lead to improvement or decline in learners' performance?

1 b) If yes, is such improvement or decline significant?

2 a) Do linguistic modifications to Mathematics test items lead to improvement or decline in learners' performance across different Mathematics abilities?

2 b) If yes, is such improvement or decline significant?

3 a) Do linguistic modifications to Mathematics test items lead to improvement or decline in learners' performance across different English language abilities?

3 b) If yes, is such improvement or decline significant?

1.4 Significance of the Study

Kon (2005) stated that a large amount of planning, budget and decisions have went into the implementation of ETeMS policy from the planning to the pedagogic stage. Thus, an extensive, multidimensional assessment is necessary to measure the usefulness of this policy to learners, parents and teachers. The study also hopes to fill in the gaps caused by the paucity of study into feasible solutions to the difficulties faced by learners and teachers affected by the ETeMS policy, apart from increasing the awareness towards the issues and importance of accountability of every player in the area of testing and assessments in Malaysia and elsewhere.

1.5 Operational Definition of Terms

1.5.1 Construct-irrelevant variances

Definition: External or internal variances such as test settings, construct settings or environment settings that could alter the validity of an instrument of testing (Abedi, Lord and Plummer, 1997).

Operational: One of such variance is linguistic difficulty of a test-items that becomes language proficiency test when the test is supposed to measure for non-linguistic proficiency in the first place.

1.5.2 Construct-irrelevant linguistic variances

Definition: Referring specifically to linguistic features of variances that could cause problems in assessing a test-items' validity

Operational: An example is when a large number of words used in a non- language test that are either unfamiliar or too difficult to the test takers to a point that the contexts set become unfamiliar to the test takers. As a result, the test-takers could not obtain the necessary information to help them to express construct competencies.

1.5.3 Construct tasks

Definition: Tasks expressed by a test-item that need to be completed as a prerequisite to consider the test-item as being relevant to the objectives of testing

Operational: Construct tasks that will be used in this study's instrument are multiplication, addition, subtract and division questions that test the test-takers on their ability on a number of topics such as units of measurements and currency.

1.5.4 Linguistic complexity index

Definition: A set of identified linguistic features that may or may not be the cause for a test-taker to perceive a test-item as being too linguistically difficult (Abedi et.al, 1997, Abedi, Lord and Hofstetter, 1998)

Operational: Refers to an index of possible linguistic features that can influence test-takers' construct ability such as length of words, familiarity of words used et cetera. A full list applicable to the instrument used in this study is available in Chapter 2. The full list is constructed based on the collection of linguistically difficult indicators from all possible Mathematical items considered for the instrumentation purposes.

1.5.5 Construct validity

Definition: Relating to how agreeable is a test to several experts' opinions as related to the objectives of designing, using and interpreting from the test itself, taking into consideration the degree of interference caused by construct irrelevant variances that may be present in the test.

Operational: Refers to the level of validity possessed by each question in the instrument of this study in relation to the aim of the construct intended. A valid indicator of the validity of each question in this study's instrument is the percentage of test casualties reported for each question or the mean index of improvement for each question pairs.

1.5.6 Linguistically complex mathematics items

Definition: Mathematics items that contain potential linguistic features that could impede a test-taker from carrying out the required functions effectively due to unfamiliarity or difficulty on the level of sentence, word, discourse or grammar. (Abedi et.al, 1997, 1998, Abedi, Courtney and Leon, 2003)

Operational: Original Mathematics items taken from authority-sanctioned standardized examinations (UPSR) that are classified as linguistically complex as measured by the linguistic complexity index.

1.5.7 Linguistically simplified mathematics items

Definition: Derived from linguistically complex mathematics items, linguistically simplified mathematics items are items that have been linguistically simplified so that the problematic linguistic features that could hinder a test-taker from carrying out the

construct tasks effectively are removed. As a result, test-takers can focus more on the tasks at hand and the test does not test the test-takers' language proficiency level instead. (Abedi et.al, 1997, 1998, 2003)

Operational: Refers to the modified version of each original, linguistically difficult Mathematics item; the modification is done based on the linguistic difficult features and suggested simplification for each item.

1.5.8 Learners' Mathematics performance

Definition: Participants' official Mathematics performance as measured through either school's own assessment or through a national or regional based standardized examination. The performance can be indicated by grade attained after a certain assessment.

Operational: For this study, participants' official Mathematics performance is based on participants' Mathematics grade in their latest semester examination in school. The grade will be reported in range of grade A to grade E.

1.5.9 Learners' English performance

Definition: Participants' official English performance as measured through either school's own assessment or through a national or regional based standardized examination. The performance can be indicated by a grade attained after a certain assessment.

Operational: For this study, participants' official English performance is based on participants' English grade in their latest semester examination in school. The grade will be reported in range of grade A to grade E.

1.5.10 Learners' score on original Mathematics test

Definition: A representation of learners' construct ability in a set of Mathematics test which contain linguistically difficult items; the achievement reported may be unfairly affected by the interference of construct irrelevant variances.

Operational: Participants' overall score in an original set of Mathematics items that contain linguistically difficult variances; the score are known to be affected by the linguistically difficult variances.

1.5.11 Learners' score on accommodated Mathematics test

Definition: A representation of learners' construct ability in a set of accommodated Mathematics test; the accommodated test items are modified to get rid of any possible irrelevant linguistic difficulties in order to obtain an unbiased picture of learners' true Mathematics ability

Operational: Participants' overall score in the accommodated test version of an originally linguistically difficult Mathematics items

1.6 Scope of the Study

There are several limitations to this study; this study focused on a limited number of linguistic modifications in the Mathematics test items. As opposed to using test items from a broad spectrum of resources such as workbooks and question banks, the test items considered for the present study were only sourced from the past year UPSR Mathematics papers. One implication of this is that the test items selected were not linguistically complex as intended as the test items may have already undergone vigorous vetting and selection.

Secondly, this study attempted to establish only any possible differences in the scores obtained by the participants between the original Mathematics items and the accommodated items. Study of correlation between variables such as the