The use of Dual-language test for bilingual students in Science Assessment

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Malaysian Education System

- Multilingual education system
- Three types of primary school primary medium of instruction:
  - National type Chinese primary school
  - National type Tamil primary school
  - National primary school (Malay being the national language)
- Two types of Secondary school:
  - National Secondary school
  - National type secondary school (Chinese language learn as a subject)
Centralised National Examinations

- **Primary School Achievement Test (UPSR)**
- **Lower Secondary Examination (PMR)**
- **Malaysian Certificate of Education (SPM)**
- **Malaysian Higher School Certificate Examination (STPM)**

All students are mandated to sit for the national examinations.

Language of assessment:
- **UPSR**: Malay, Chinese & Tamil
- **PMR, SPM, STPM**: Malay only
Centralised Examinations

- High stake examinations used for making important decisions
- UPSR – selection of candidates into fully residential schools (for Malay students only), premiere secondary schools
- PMR – selection into science schools (for Malay students only)
- SPM – entry into pre-university colleges, Form 6, teacher training program, government scholarship
- STPM – entry into university program
Language Policy

- Malay language has been the medium of instruction for the national secondary schools (1980) & national primary schools (1968)
- In 2003, the Ministry of Education implemented the policy of teaching science and mathematics in English
- The national examinations for science and mathematics are administered in dual-language, e.g. Malay and English for the secondary level national examinations.
In 2006, 24.1% of the candidates chose to answer in English, 46.2% still answered in Malay while 29.7% answered in both languages (Star, 2006).

Among the candidates who answered in Malay, they were however using the mathematical terms in English.
Reversal of Language Policy

The Education Minister has recently announced the reversal of the language policy to mother tongue; Malay, Chinese and Tamil for the teaching of science and mathematics in the primary schools beginning with Standard 1 in the year 2012

(The Star, July 2009)
Validity Issue

• Question on comparability of the standardized achievement tests that use different language of assessment.
• The use of dual-language test for science and mathematics: Does this eliminate the language factor?
Language Proficiency & Testing

- Students who are still in the process of learning English when tested in English, their proficiency in English will also be tested (AERA, APA, & NCME, 1999)

- For students with limited English proficiency, the language of test items can prevent them from demonstrating their knowledge in the area of science and mathematics (Abedi, Lord, & Plummer, 1997)
Linguistic Accommodation in Content Areas Test

Content-based standardized achievement tests aim to measure students’ knowledge of specific content areas.

Reduce the English language load by making test more accessible to limited English proficient students (Liu et al., 1999).

Types of linguistic accommodation

- Use of native language (Rivera, 2006),
- dual-language test (Garcia, 2000),
- dictionary, bilingual glossary (Abedi, Courtney, & Leon 2003),
- linguistic simplified test (Abedi, 2001, Riverra & Stansfield, 2003/4 ) and
- use of figures and diagrams (Fairbairn, 2006).
Reason for Dual-language Test in Malaysia

- Malaysian students most likely operate in two languages as the primary medium of instruction is Malay but the language of instruction for science is English.
- Candidates can gain additional information and comprehend the question better in one of the languages they are proficient in, or utilise both language versions.
Dual-language Test

- Adopted by the Malaysian Examination Syndicate (MES), the provider of the national level assessments
- Dual-language booklet is used for all examinees in the national level science and mathematics examinations
- UPSR
  - Malay and English
  - Chinese & English
  - Tamil & English
- PMR, SPM & STPM
  - Malay & English
- Dual-language test is an additional burden, for school level assessment, teachers used only English.
Translating math tests into the native language of LEP students was found to be not helpful if math instruction took place in English (Abedi, Lord, & Hofstetter, 1998).

Garcia et al.’s (2000) results showed that the dual-language maths test booklet assists those students who were less proficient in English.

Students in Garcia et al.’s study perceived the math dual-language test booklet as beneficial although they tended to use and answer in one language (English).
Aim of study

1) To investigate the effect of the use of dual-language test booklet in addressing the linguistic needs of Malaysian students.

2) To what extent the dual-language test will raise the science achievement by improving students’ comprehension of test items.
40 items aligned with the Malaysian science curriculum were selected from the 1999 and 2003 TIMSS eight-grade public release science items.

Three bilingual science teachers translate the items into Malay.

Two separate science test booklets were created.

- The English-only science items.
- The English and Malay science items.

The test is administered in 40 minutes.
Participants

- 1,720 eight-grade students from 26 secondary schools
- While in primary schools, science were taught to these students in either Malay, Chinese or Tamil language
- When they enter secondary school, the medium of instruction for science changed to English
- At the time of administering the test, students have undergone 2 years of science learning in English (Form I & II)
Data Collection

- 876 students were administered the dual-language science test
- 844 students took the English-only science test
- The test was administered to the participants at the end of the school year, October 2008.
- The English-only test and the dual-language test was assigned randomly to students
## Language used by science teacher

<table>
<thead>
<tr>
<th></th>
<th>Dual-language Group</th>
<th>English Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malay only</td>
<td>1.7% (15)</td>
<td>1.3% (11)</td>
</tr>
<tr>
<td>English only</td>
<td>19.9% (174)</td>
<td>21.3% (180)</td>
</tr>
<tr>
<td>English &amp; Malay equally</td>
<td>42.4% (371)</td>
<td>36.3% (306)</td>
</tr>
<tr>
<td>Malay more than English</td>
<td>11.5% (101)</td>
<td>13.0% (110)</td>
</tr>
<tr>
<td>English more than Malay</td>
<td>24.0% (210)</td>
<td>27.5% (232)</td>
</tr>
</tbody>
</table>
Use of Dual-language Test by participant

<table>
<thead>
<tr>
<th>Use</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use only Malay</td>
<td>118</td>
<td>13.5</td>
</tr>
<tr>
<td>Use only English</td>
<td>207</td>
<td>23.6</td>
</tr>
<tr>
<td>Use Malay more than English</td>
<td>179</td>
<td>20.4</td>
</tr>
<tr>
<td>Use English more than Malay</td>
<td>149</td>
<td>17.0</td>
</tr>
<tr>
<td>Use English &amp; Malay equally</td>
<td>176</td>
<td>20.1</td>
</tr>
<tr>
<td>Omit response</td>
<td>47</td>
<td>5.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>876</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>
Data Analysis

- Comparing science achievement
  - Score distribution plots
  - Boxplots
  - Moments
  - Test equating

- Comparing characteristics of tests
  - Item parameters
  - Differential Item Functioning

- Software: Lertap
## Mean Item Parameter

<table>
<thead>
<tr>
<th></th>
<th>Bilingual Item</th>
<th>English Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Item Difficulty</td>
<td>0.500</td>
<td>0.499</td>
</tr>
<tr>
<td>Mean Item Discrimination</td>
<td>0.398</td>
<td>0.424</td>
</tr>
<tr>
<td>Mean Point Biserial</td>
<td>0.354</td>
<td>0.367</td>
</tr>
<tr>
<td>Mean Adj. Point Biserial</td>
<td>0.292</td>
<td>0.308</td>
</tr>
<tr>
<td>KR20 (Alpha)</td>
<td>0.824</td>
<td>0.837</td>
</tr>
<tr>
<td>KR21</td>
<td>0.798</td>
<td>0.817</td>
</tr>
<tr>
<td>SEM (from KR20)</td>
<td>2.816</td>
<td>2.827</td>
</tr>
</tbody>
</table>
Item Difficulty (Proportion Correct)

Comparing Item Difficulty

Proportion Correct

Item Number

English Average
Bilingual Average
13 items seem to be slightly easier when presented in dual-language format.

Two items, Item 15 & Item 35, become very much easier in the dual-language format.
Comparing item difficulty (Proportional Correct)

<table>
<thead>
<tr>
<th>Item Number</th>
<th>English</th>
<th>Bilingual</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>0.58</td>
<td>0.74</td>
<td>-0.16</td>
</tr>
<tr>
<td>35</td>
<td>0.48</td>
<td>0.68</td>
<td>-0.20</td>
</tr>
<tr>
<td>Mean</td>
<td>0.499</td>
<td>0.500</td>
<td></td>
</tr>
</tbody>
</table>
The burning of fossil fuels has increased the carbon dioxide content of the atmosphere. What is a possible effect that the increased amount of carbon dioxide is likely to have on our planet?

- a) A warmer climate
- b) A cooler climate
- c) Lower relative humidity
- d) More ozone in the atmosphere

Pembakaran bahan api fosil menambahkan kandungan karbon dioksida dalam atmosfera. Apakah kesan yang mungkin berlaku akibat penambahan karbon dioksida pada planet kita?

- a) cuaca yang lebih panas
- b) cuaca yang lebih sejuk
- c) kurangkan kelembapan relatif
- d) lebih banyak ozon pada atmosfera
Why dual-language Item 15 is easier?

- When presented in a language that most students are not proficient, the item stem is too wordy
- Bilingual students are put off by the long text used to describe the stimulus
Options selection (Item 15)

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>58%</td>
<td>7%</td>
<td>14%</td>
<td>20%</td>
</tr>
<tr>
<td>B</td>
<td>74%</td>
<td>5%</td>
<td>8%</td>
<td>12%</td>
</tr>
</tbody>
</table>
Item 35

Overgrazing of land by livestock contributes to a major problem.
That problem is
a) depletion of ground water
b) increased pollution
c) erosion of soil
d) acid rain

Meragut rumput di kawasan tanah secara berlebihan oleh ternakan menyumbang kepada masalah berikut:
a) pengurangan air tanah
b) peningkatan pencemaran
c) hakisan tanah
d) hujan asid
Why Item 35 is difficult?

- The terms ‘overgrazing’ and ‘livestock’ are uncommon words among Malaysian students.
- The translation to Malay probably enable them to understand the question better.
Options Selection (Item 35)

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>15%</td>
<td>24%</td>
<td><strong>48%</strong></td>
<td>11%</td>
<td>2%</td>
</tr>
<tr>
<td>B</td>
<td>14%</td>
<td>9%</td>
<td><strong>68%</strong></td>
<td>8%</td>
<td>1%</td>
</tr>
</tbody>
</table>
## Score Distribution

<table>
<thead>
<tr>
<th></th>
<th>Dual-language Test</th>
<th>English-only Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total possible score</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Minimum score</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Maximum score</td>
<td>39</td>
<td>39</td>
</tr>
<tr>
<td>Median score</td>
<td>19</td>
<td>19.5</td>
</tr>
<tr>
<td>Mean score</td>
<td>19.99</td>
<td>19.95</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>6.72</td>
<td>7.01</td>
</tr>
<tr>
<td>Variance</td>
<td>45.12</td>
<td>49.13</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.27</td>
<td>0.28</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-0.60</td>
<td>-0.63</td>
</tr>
<tr>
<td>Number of examinees</td>
<td>876</td>
<td>844</td>
</tr>
</tbody>
</table>
Score Distribution

Raw Score

Frequency

1 5 9 13 17 21 25 29 33 37

Score Distribution

Bilingual

English
Score distribution with Boxplot

Simulated Boxplot for 'BilEng'
MH DIF plots (Item 35)

- MH alpha=.41, MH d-DIF=2.12, ETS level (C) large DIF
- Dual-language is easier (from score range 9-26)

Red line: Dual-language
MH- DIF plots (Item 15)

- Item 15: MH alpha=.42, MH d-DIF=2.04, ETS level (C) large DIF

- Dual-language is easier, from score range (9-24)
MH-DIF plot (Item 29)

- MH alpha = 1.57, MH D-DIF = -1.06, ETS level; B (moderate)
- Item in English is easier than dual-language (for score range from 9-22)
MH-DIF plot (Item 36)

- MH alpha = .60, MH D-DIF = 1.21, ETS level; B (moderate)
- Dual-language is Easier (only for score range from 12-19)
Use of Dual-language Test

- Most students (those given the dual-language test) used both Malay and English when answering the science test.
- Students perceived the dual-language test booklets as useful.
Students Science Achievement

- Similar score distribution pattern obtained
  - From graphical plot of score distribution
  - Boxplot
  - Skewness & Kurtosis

- Overall, students science achievement is not improved with the use of dual-language test
Dual-language Item Characteristics

- Less than half of the multiple-choice test items were found to be slightly easier when presented in dual-language.
- Only two items become much easier significantly with the presence of the additional language and is said to exhibit large differential item functioning.
The extra language version of the science test did not provide additional advantage to the students, there were no difference in the overall performance.

Only two items become very much easier with the additional language version.
Implication

- Other form of accommodation, e.g. use of diagrams may be more useful for these bilingual students.
- Content knowledge may be the more important factor that determines students’ achievement in science.
- More emphasis should be on the teaching of science content.
- Results may be different when open-ended items are used.
Thank You