Teaching science and mathematics in English steering mastery in English language amongst science students in UKM

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Abstract

This study was conducted to ascertain teaching Science and Mathematics in English will enhance English proficiency amongst the science stream students in UKM. The study found that the students agreed that the teaching of Science and Mathematics in English can improve their English proficiency. The results showed that teaching Science and Mathematics in English is capable of being a driven force in mastering basic English language and communication, and also in improving the explanation of the concept of Science and Mathematics in English.

Keywords: Driven force; English proficiency; language; mathematics and science

1. Introduction

In 2003, Malaysian Ministry of Education implemented a policy in teaching and learning English in Science and Mathematics (PPSMI) to the education system. The preference to use English was based on the rationale that mastery of English is regarded as an important mechanism for students to acquire proficiency in English in the field of science and technology. Nevertheless, there were lots of feedbacks and criticisms against supporting this policy from various issues. Studies on the effectiveness of this policy in educations have been conducted, such as by Yahaya et al., (2009), Ong and Tan (2008), Aziz (2005), Neville-Barton and Barton (2005) and Foong (2003). Therefore, the government has come to a decision to terminate and abolish the policy and introduce a new policy;
Improving the quality of Malay Language, Strengthening English language (MBMIBI) in year 2012 (Malaysia kini, 2009; Bernama, 2009). However, now this new policy has slowly been introduced to the education system. Although the PPSMI policy is going to be abolished, we have to review the effect of the PPSMI implementation on the students’ English language proficiency. Various studies has been done to review this issue by academicians such as Zaidi et al. (2011), Noriza et al. (2011), Wan Rosmanira et al., (2011), Berita Harian (2010, 2011) and mStar (2009) and Tuah and Mohini (2008).

Therefore, this study aims to investigate the outcome of the PPSMI implementation among the students of higher institution in steering mastery English language, mainly amongst the sciences students in Universiti Kebangsaan Malaysia (UKM).

2. Methodology

The data for this study was obtained through questionnaires distributed to the sciences students in UKM from the Faculty of Science and Technology (FST), Faculty of Education (FPEND), Faculty of Engineering and Built Environment (FKAB) and Faculty of Information Science and Technology (FTSM). The faculties were chosen to fulfill the objectives of the study due to the students’ background where they had undergone the learning of science in English since their secondary school level until they further higher studies in UKM.

The number of respondents involved was 435 students, in which 187 from FST, 103 students from FPEND, 54 students from FKAB and 91 students from FTSM. A Likert scale ranging from 1 to 10 was used to measure the capability of teaching and learning of Science and Mathematics (S&M) in English, being a driven force in mastering basic English language and communication, and also in improving the explanation of the concept of S&M in English. The scale ranges from 1 that represents strongly disagree while 10 represents strongly agree to 3 questions about students’ mastery in English language. The scale range was then divided into two categories; agree and disagree. An average score of 1 to 7 showed that the students disagree that teaching English in S&M would enhance their English proficiency, while an average score of 8 to 10 showed otherwise.

A descriptive analysis was done to look at respondents’ profiles based on demographic factors. In order to measure either the students agree or disagree with teaching English in S&M would enhance the students’ mastery level in English language, the odds ratio method is used.

The odds ratio measures the strength between two binary data (agree and disagree) explaining how much more likely it is that students disagree with teaching English in S&M would not enhance their competency level in English language (first group) as compared to the students that agree (second group). An odds ratio of 1 implies that the event is equally likely in both groups. An odds ratio greater than one implies that the event is more likely in the first group. An odds ratio less than one implies that the event is less likely in the first group. Besides that, the study also investigated either the demographic factors associate with the odds ratio outcome or not.

3. Study Results

3.1 Profile of Respondents

The number of respondents involved was 441 students, in which 188 from FST, 103 students from FPEND, 57 students from FKAB and 93 students from FTSM. The background information of the respondents is displayed in Table 1. Majority of the respondents are female FST students followed by FTSM and FPEND. There are more male students at FKAB than female students. Majority of the respondents are Malays, followed by Chinese, Indians and others, except for FTSM respondents where Chinese are slightly more than the Malays. According to the year of studies, for third year students, the majority are from FPEND, while for second year students are from FST and FTSM and for first year students are from FKAB. Most respondents obtained a Malaysian University English Test (MUET) grade of at least Band 3 out of maximum band of 6. The result shows that majority of the respondents are those from FST, FPEND and FKAB with Matriculation certificate while FTSM students are those who obtained STPM (Malaysian Higher School Certificate) certificate. Matriculation Program is a preparatory program for Malaysian students to qualify them to Degree Programs in the fields of Science and Technology in both local and overseas universities.
In terms of verbal command at home, majority of the respondents use Malay language, followed by Mandarin, English and others. This is consistent with the races of the students. This shows that most FST, FPEND and FKAB students communicate in Malay language as a medium of command in primary and secondary school levels, while in Mandarin for FTSM students. However, English is the medium of command at pre-university level for most students from FST, FKAB and FTSM. Meanwhile, FPEND students are classified into two groups; one group learned in Malay language while the other in English.

Table 1. Respondents’ background

|                | FST Frequency (%) | FPEND Frequency (%) | FKAB Frequency (%) | FTSM Frequency (%) |
|----------------|-------------------|---------------------|-------------------|-------------------|
| Gender Male    | 73 (16.6)         | 40 (9.1)            | 33 (7.5)          | 23 (5.2)          |
| Gender Female  | 115 (26.1)        | 63 (14.3)           | 24 (5.4)          | 70 (15.9)         |
| Race Chinese   | 67 (15.2)         | 46 (10.5)           | 17 (3.9)          | 48 (10.9)         |
| Race Indian    | 13 (3.0)          | 1 (0.2)             | 7 (1.6)           | 1 (0.2)           |
| Race Malay     | 106 (24.1)        | 54 (12.3)           | 30 (6.8)          | 38 (8.6)          |
| Race Others    | 2 (0.5)           | 2 (0.5)             | 3 (0.7)           | 5 (1.1)           |
| Year of Study Year 1 | 34 (7.8)     | 0 (0.0)             | 29 (6.6)          | 1 (0.2)           |
| Year of Study Year 2 | 107 (24.5)    | 5 (1.1)             | 25 (5.7)          | 87 (19.9)         |
| Year of Study Year>=3 | 46 (10.5)   | 98 (22.4)           | 1 (0.2)           | 4 (0.9)           |
| MUET Grade Band 1 | 2 (0.5)      | 6 (1.4)             | 0 (0.0)           | 1 (0.2)           |
| MUET Grade Band 2 | 28 (6.4)     | 18 (4.1)            | 5 (1.1)           | 14 (3.2)          |
| MUET Grade Band 3 | 103 (23.5)    | 40 (9.1)            | 28 (6.4)          | 48 (11.0)         |
| MUET Grade Band 4 | 47 (10.7)    | 32 (7.3)            | 22 (5.0)          | 25 (5.7)          |
| MUET Grade Band 5 | 5 (1.1)      | 7 (1.6)             | 2 (0.5)           | 3 (0.7)           |
| MUET Grade Band 6 | 2 (0.5)      | 0 (0.0)             | 0 (0.0)           | 0 (0.0)           |
| UKM Entry Qualification Diploma | 4 (0.9)  | 13 (3.0)            | 0 (0.0)           | 12 (2.7)          |
| UKM Entry Qualification Matriculation | 152 (34.5) | 44 (10.0)           | 43 (9.8)          | 32 (7.3)          |
| UKM Entry Qualification STPM | 27 (6.1)    | 42 (9.5)            | 14 (3.2)          | 45 (10.2)         |
| UKM Entry Qualification Senior High School | 5 (1.1)  | 4 (0.9)             | 0 (0.0)           | 3 (0.7)           |
| Language at Home Mandarin | 26 (5.9)   | 42 (9.5)            | 16 (3.6)          | 48 (10.9)         |
| Language at Home English | 47 (10.7)  | 4 (0.9)             | 3 (0.7)           | 3 (0.7)           |
| Language at Home Malay Language | 107 (24.3) | 55 (12.5)           | 30 (6.8)          | 39 (8.8)          |
| Language at Home Tamil | 8 (1.8)   | 0 (0.0)             | 5 (1.1)           | 2 (0.5)           |
| Language at Home Others | 0 (0.0)   | 2 (0.5)             | 3 (0.7)           | 1 (0.2)           |
| Learning Language at Primary School Level Mandarin | 14 (3.2) | 3 (0.7)             | 15 (3.4)          | 45 (10.2)         |
| Learning Language at Primary School Level English | 10 (2.3)  | 0 (0.0)             | 5 (1.1)           | 1 (0.2)           |
| Learning Language at Primary School Level Malay Language | 159 (36.1) | 100 (22.7)          | 35 (7.9)          | 46 (10.4)         |
| Learning Language at Primary School Level Tamil | 5 (1.1)   | 0 (0.0)             | 2 (0.5)           | 1 (0.2)           |
| Learning Language at Secondary School Level Mandarin | 4 (0.9)  | 0 (0.0)             | 0 (0.0)           | 9 (2.0)           |
| Learning Language at Secondary School Level English | 36 (8.2)  | 1 (0.2)             | 24 (5.4)          | 7 (1.6)           |
| Learning Language at Secondary School Level Malay Language | 144 (32.7) | 102 (23.1)          | 33 (7.5)          | 76 (17.2)         |
| Learning Language at Secondary School Level Tamil | 4 (0.9)   | 0 (0.0)             | 0 (0.0)           | 1 (0.2)           |

Table 1. Respondent’s background (cont’d)
Students were asked to rate themselves for their command of English in reading, listening, writing and speaking. A Likert scale ranging from 1 to 5 was used to rate the students’ competency in English. The scale of 1 represents weak command while 5 represents excellent command. Table 1 shows that most of the students from each faculty felt that their reading and listening skills in English are satisfactory while the writing and speaking skills in English are average. Very few of them felt that they were weak or excellent in reading, listening, writing and speaking skills in English.

### 3.2 Analysis of Odds Ratio

The results in Table 2 shows that students with unsatisfactory English competency, are most likely to disagree to the teaching of S&M in English with the odds of 109/90=1.211. However, those who also have unsatisfactory English level but agree to the teaching of S&M in English have the odds of 78/158=0.4937. The odds ratio is then calculated by OR=(109/158)/(90/158)=2.453, with 95% C.I (1.662, 3.621), showing that students who disagree with the teaching of S&M in English are more likely to be less competent in English compared to those who agree. In this case there is an association between teachings of S&M in English with English competency level.

### Table 2. Classification of English Competency and Teaching of S&M in English

| Teaching S&M in English would improve English language competency | English competency | Total | Odds ratio |
|---------------------------------------------------------------|--------------------|------|-----------|
|                                                              | Unsatisfactory    | Satisfactory |         |
| Disagree                                                     | 109                | 90        | 199      |
| Agree                                                        | 78                 | 158       | 236      |
| Total                                                        | 187                | 248       | 435      |

Further analysis is carried out to ascertain whether this association is confounded by certain confounding factors such as ethnic, academic qualification, faculties, academic year and MUET grades. For example, the ethnic might confound the association between English competency and the teaching of S&M in English. One way to address
confounding is to stratify the data into relatively homogenous subgroups (“strata”) according to the confounding factors.

3.2.1 Stratification by Ethnic

For this analysis, we compare the agreement level of teaching S&M in English by ethnic groups and investigated whether the odds ratio vary among Chinese and non-Chinese students as shown in Table 3. Non-Chinese students consist of the Malays and Indian students. The Indians is grouped together with the Malays due to small number of Indian students.

| Ethnic      | Teaching of S&M in English | Odds Ratio |
|-------------|---------------------------|------------|
| Chinese     | Disagree                  | 36         | 36         | 1.69       |
|             | Agree                     | 39         | 66         |            |
| Non-Chinese | Disagree                  | 70         | 54         | 2.73       |
|             | Agree                     | 39         | 82         |            |

The odds ratio for Chinese and non-Chinese (Malays and Indians) are 1.69 and 2.73 respectively. The odds ratio differs when stratified by ethnic. Test of homogeneity, gives \( \chi^2 = 2.353, \) \( p\)-value \( =0.125 \) which signifies no significant difference between the strata odds ratios and shows that there is no interaction between the agreement level towards teaching S&M in English and ethnicity. Ethnic is a confounding factor for the relationship between teaching S&M in English and the competency of English language. Since, the odds ratio across ethnic are considered homogenous we used the common odds ratio adjusted for ethnic, OR=2.435 as estimate. The students who disagree to the teaching of S&M in English are more likely to have lower English competency than those who agree.

3.2.2 Stratification by Academic qualification

An odds ratio for each category for academic qualification is calculated as in Table 4. Even though there seem to be differences in odds ratio but the differences are not large enough. The homogeneity test of odds ratio shows that \( \chi^2 = 6.188, \) \( p\)-value \( =0.103 \) (two sided), which concludes that there are no significant differences in odds ratio across academic qualification. In this case, there is no interaction between the agreement level and academic qualification and concludes that academic qualification is a confounder. An estimate of common odds ratio after adjustment for academic qualification is 2.629. The students who disagree with the teaching of S&M in English are more likely to be from the lower English competency group.

| Academic Qualification | Teaching of S&M in English | Odds Ratio |
|------------------------|---------------------------|------------|
| Diploma                | Disagree                  | 6          | 11         | 17         | 0.545     |
|                        | Agree                     | 6          | 6          | 12         |            |
| Matriculation          | Disagree                  | 66         | 61         | 127        | 2.802     |
|                        | Agree                     | 39         | 101        | 140        |            |
| STPM                   | Disagree                  | 35         | 14         | 49         | 3.96      |
|                        | Agree                     | 30         | 47         | 77         |            |
| Senior high school     | Disagree                  | 2          | 4          | 6          | 1.00      |
|                        | Agree                     | 2          | 4          | 6          |            |

Table 3. Odds ratio after stratification by Ethnic

Table 4. Odds ratio after stratification by Academic qualification
3.2.3 Stratification by Faculty

Stratification by faculty as in Table 5 shows that the odds ratio varies across strata, with FKAB having the highest odds ratio. The homogeneity test, \( \chi^2 = 5.084 \), p-value = 0.17 (two sided), shows that there is no significant difference in the odds ratio and interaction does not exist between Faculty and agreement level towards teaching S&M in English. Faculty is another confounding factor. The estimate for common odds ratio after adjusted for Faculty is 2.412, which concludes that the students who disagree with the teaching of S&M are more likely to unsatisfactory English competency.

| Faculty | English competency | Total | Odds Ratio |
|---------|--------------------|-------|------------|
|         | Unsatisfactory     | Satisfactory |          |
| FKAB    | Disagree           | Agree  | 12  | 4 | 16  | 9.667  |
|         | 21                 | 33     |     |   | 54   |
| FPEND   | Disagree           | Agree  | 37  | 29 | 66  | 2.355  |
|         | 13                 | 24     |     |   | 37   |
| FST     | Disagree           | Agree  | 45  | 42 | 87  | 2.175  |
|         | 33                 | 67     |     |   | 100  |
| FTSRM   | Disagree           | Agree  | 15  | 15 | 30  | 1.652  |
|         | 23                 | 38     |     |   | 61   |

3.2.4. Stratification by academic year

Stratification by academic year investigates whether students from different academic year have different opinion regarding the teaching of S&M in English. From Table 6, the odds ratios by academic year shows variation in the odds ratios, however, the homogeneity test with \( \chi^2 = 3.038 \), p-value = 0.219 (two sided), shows there is no significant difference among the odds ratio between the academic years. No interaction exist between the agreement level towards teaching S&M in English and academic year and conclude that academic year is a confounder. The estimate of common odds ratios is 2.317 after adjusted for academic year.

| Academic year | English competency | Total | Odds ratio |
|---------------|--------------------|-------|------------|
|               | Unsatisfactory     | Satisfactory |          |
| First year    | Disagree           | Agree  | 16  | 7 | 23  | 5.143  |
|               | 12                 | 27     |     |   | 39   |
|               | 28                 | 34     |     |   | 62   |
| Second year   | Disagree           | Agree  | 42  | 38 | 80  | 2.411  |
|               | 44                 | 96     |     |   | 140  |
|               | 86                 | 134    |     |   | 220  |
| Third year and above | Disagree           | Agree  | 49  | 45 | 94  | 1.633  |
|               | 22                 | 33     |     |   | 55   |
|               | 71                 | 78     |     |   | 149  |

3.2.5. Stratification by MUET grades

For stratification by MUET grades, we have to regroup the data for the lowest and highest bands due to small number of students in those groups. We grouped Band 1 with Band 2 and Band 5 with Band 6. The resulting odds ratios are as shown in Table 7. Even though there are variations in the odds ratios between bands but these differences are not significant as shown from the homogeneity test with \( \chi^2 = 3.195 \), p-value = 0.363 (two sided). The estimate of common odds after adjusted for MUET grades is 1.877.
Table 7. Odds ratio after stratification by MUET grades

| MUET Grades | English competency | Odds Ratio |
|-------------|--------------------|------------|
|             | Unsatisfactory     | Satisfactory |          |
| Band 1&2    | Disagree           | 31         | 11       | 42       | 0.841 |
|             | Agree              | 20         | 5        | 22       |       |
| Total       |                    | 48         | 16       | 64       |       |
| Band 3      | Disagree           | 58         | 56       | 114      | 2.233 |
|             | Agree              | 32         | 69       | 101      |       |
| Total       |                    | 90         | 125      | 215      |       |
| Band 4      | Disagree           | 12         | 17       | 29       | 2.271 |
|             | Agree              | 23         | 74       | 97       |       |
| Total       |                    | 35         | 91       | 126      |       |
| Band 5&6    | Disagree           | 1          | 5        | 4        | 0.60  |
|             | Agree              | 3          | 9        | 12       |       |
| Total       |                    | 4          | 12       | 16       |       |

4. Conclusion

The study on whether teaching Science and Mathematics in English will enhance English proficiency amongst the science stream students in UKM showed that there is an association between students who disagree with the teaching of S&M in English and their English competency. The students who disagree with the teaching of S&M in English are more likely to be less competent in English compared to those who agree. The relationship between the agreement level of teaching S&M and English competency is found to be confounded by ethnic, academic qualification, faculties, academic year and MUET grades. No interaction was observed between the agreement level of teaching S&M and confounding factors.

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