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Grade five indigenous (Orang Asli) pupil's achievement in bilingual versions of mathematics test

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Abstract

The purpose of this study is to investigate Indigenous pupils' achievement in Mathematics with Bilingual (Bahasa Melayu and Temiar) versions of mathematics tests. Both tests were based on Mathematics computation and word problem items. This study involved eight Orang Asli (Indigenous) primary students from eight schools in the district of Sungai Siput, Perak. A total number of 230 Grade 5 (11 years old) pupils participated in the study. Difficulty index was used to measure pupils' achievement in mathematics computation and word problem items involving Bahasa Melayu and Temiar (the Orang Asli native language). 50 Multiple Choice Items (MCI) were administered in two languages which were the Malay language and Bilingual (Malay and Temiar) languages, where the Temiar language is the Orang Asli's language in the oral form. The oral form of the Temiar language was translated from the Malay language by Temiar native language experts, which were then audio recorded by the researchers. The study provide evidence that the Bilingual test version that used Temiar language is easier for the pupils and this version had also improved Grade 5 pupil's achievement in mathematics word problems items in. It is conjectured that the Orang Asli pupils' performance in the computation test is better than the word problem items in Mathematics.

Keywords: Mathematics Computation; Mathematics Word Problem; Bahasa Melayu; Bilingual Version; Temiar

1. Introduction

The active learning of mathematics can provide students with meaningful learning experiences and opportunities to produce quality, creative and innovative works (Kim & Md-Ali, 2017). There are many approaches to teaching mathematics that potentially enhance active learning of mathematics in schools. For example, the Realistic Mathematics Education (RME) is one such approach, which portrays mathematics through rich and real-life situations to accommodate students' learning process. Learning mathematics is a human activity and the learning process consists of solving everyday life problems that are within their living context, through the use of appropriate mathematical skills. These contextual problems serve as a vehicle that facilitates "the development of mathematical concepts,

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tools and procedures in the students" (John & Van De Walle, 2004). It is indeed vital for children to acquire mathematical skills because, as expounded by the National Council of Teachers of Mathematics (NCTM) Standards, understanding numbers will help them to sensibly apply the mathematical skills in their daily life (Romberg, 1989).

The *Orang Asli* children in Malaysia face an extra challenge to learn Mathematics due to having a social background that is very different from the mainstream students. This is an important feature that influences *Orang Asli* pupils' learning because school syllabus lacks connection to their society and culture. The design of the syllabi and curriculum reflect the general student population, but the learning capabilities of the *Orang Asli* pupils are very different from their peers in Malaysia. The capability of these pupils are different when compared to the general student population (Hanafi, et al., 2014). They often find the content of their teachers' teaching as something very alien and difficult for them to understand and assimilate because the content does not relate much to their community's culture. Teachers report this phenomenon as the most frustrating factor in their effort to teach the *Orang Asli* students. However, the study suggested that the solution to this challenge is by having educators who are well-informed of the pupils' cultural background. The teaching and learning materials should also be adapted to fit into these pupils' existing concepts and their pre-requisite knowledge to lessen their burden of comprehension and also to make the whole experience of learning mathematics in the classrooms more relatable and meaningful.

Current mathematical assessments have pointed a worrying phenomenon, which is pupils have difficulty in mastering mathematical concepts for multiple reasons. A study based on students' results in national examinations and from international studies show that the *Orang Asli* students' achievement in Mathematics have been unsatisfactory (Retnawati, et al., 2017). Multiple studies show a low level of absolute and marginal learning levels, and students are incapable of answering numeracy problems at primary level, which include topics such as *Whole Numbers*, *Fractions* and *Decimals* (Beatty, et al., 2018; Pritchett, 2018).

Grade Five pupils' mathematics performance in Thailand offer a more in-depth insight into which level of mathematical processing proves to be challenging to the students. Out of the five levels, the transformation level (*Can the student select the correct mathematical procedures?*) and process skills level (*Can the student perform the mathematical calculation or the procedure accurately?*) relate closely to the students' mathematical ability. The study uncovered that two items indicate students' inability to both select an appropriate mathematical operation to obtain the answer and perform correctly the mathematical calculations (Prakitipong Nakamura, 2006). If this challenge is experienced by mainstream students, the impact is even more acutely felt by the Indigenous pupils.

Mathematical operations undeniably involve knowledge about numbers. The *Orang Asli* pupils, like all other pupils, need to acquire numeracy skills to solve problems that they encounter in their everyday life (Sabidin, et al., 2017). However, despite having adequate numeracy skills, the *Orang Asli* pupils were still found to face problems when solving sums involving multiplication, division, and word problems (Ismail, et al., 2020). In fact, they are weak in the word problem items on all topics presumably due to their difficulty to read and understand the problems. Additionally, the study also noted that the *Orang Asli* pupils indicate a high-level of performance for numeracy in oral test compared to their performance in written test. In relation to assessing children's mathematical knowledge, they must be given the opportunity to show their mathematical knowledge in oral mode of the mathematics examination because they potentially can perform better in oral examination (Videnovic, 2017).

Realistic Mathematics Education (RME) consists of several core principles for teaching mathematics, mostly revolving around the learning activities. Mathematics is taught as a

human *activity*, and students are viewed as key components in the process of learning by being actively involved doing the mathematics. The problems adopted in the classroom reflect the *reality*, meaning that it should be as close to reality as possible and also meaningful to the students, which allows them to attach meaning to the mathematical constructs they develop while solving the problems. Mathematical content domains are also *intertwined* rather than viewed as isolated concepts to offer students an integrated and rich perspective of problems in which they can engage various mathematical tools and knowledge. Other key principles such as *guidance* and *interactivity* signify that student should be allowed to reinvent mathematical concepts, with group work and whole-class discussions respectively. Both of these principles aim to provide a catalyst for students to reach a higher level of understanding. Given these characteristics, RME is considered a very promising approach to improve mathematics teaching and learning (Lerman, 2014).

In the local setting, Malaysian students also face difficulty with Mathematics. The Programme for International Student Assessment (PISA) achievement in 2015 reported that Malaysia was behind countries such as Singapore, Taiwan, and Thailand. The study also indicates that local national school primary pupils' performance in Mathematics as being low to medium. Out of 110 students, only 22 could be categorised as high performers. A more disturbing statistics is that 55.45% of the students was ranked as low in Mathematics (Bernardo, 2005).

Students encounter difficulty during tests when they do not understand the concepts required to complete the test. Several mathematics-related difficulties such as reading and comprehending word-problems, writing a number sentence, carrying out the calculation, which includes using accurate methods and not making mistakes (Abedi, et al., 2006). Mathematical items often involve multiple skills mentioned above, which pose a considerable challenge to students, who have not mastered the fundamentals of the subject (Retnawati, et al., 2017). The issue becomes more challenging when students are not able to comprehend the underlying meanings embedded within the test items due to the language of the test, which is not their native language. The majority of the teachers who are teaching mathematics in the *Orang Asli* primary schools have very little knowledge and may lack competence in their students' first language (Roti, et al., 2000).

1.1. Language and Mathematics

Mathematics is context-based and language bound especially for word problem items where language can either assist or obstruct pupils' mathematical achievement. The language of the mathematical items affect bilingual pupils' achievement in Mathematics assessment especially for word problems because their language proficiency are influenced by their level of exposure to their native language spoken in their homes and language of instructions used formally in schools. As a results, using a less proficient language negatively affects their mathematics performance (Tanius, et al., 2018).

The language components of a mathematics item is capable of masking students' actual performance in Mathematics. The effect is even stronger when pupils use a less proficient language or their non-dominant language. Therefore, adequate opportunity in the form of test accommodation needs to be provided to ensure that students have a fair opportunity to demonstrate their performance in Mathematics assessments (Dalton-Puffer, 2011).

A study to understand pupils' comprehension on the language of mathematics word problems among 5th and 6th graders at a middle school suggests similar notion. Analysis of the data showed a number of factors as the probable cause for their lack of competence to solve mathematical problems. The factors include difficulty in finding out the relationship between the words and the symbols in mathematical problems, dependent on superficial cues that can lead to incorrect solutions, or solutions

that make little sense in terms of the language of the problem, and the language used in mathematical problems that is different from their everyday language These factors resulted in some comprehension difficulties (Brinton, et al., 2003).

It takes time and a lot of experience for pupils to develop a full understanding of the number system, which will be enhanced across all school grades. Many students do not get those opportunities, and therefore they find it difficult to learn concepts of mathematics because of this difficulty. Examples of epistemological difficulties are as follows: (a) students might be unable to make the connection of the number and the quantity it represents. (b) student might encounter trouble in connecting symbolic notation of mathematics to real world situations. (c) students might exhibit problems in visual, spatial or sequential aspects of mathematics and hence might either be confused when learning multi-step procedures, or might find it problematic to order the steps required to solve a problem (Douglas, 2004; Veloo, et al., 2015).

1.2. Content-and-language Integrated Learning (CLIL) Education Model

Teaching of mathematics in the *Orang Asli* primary schools apparently need to focus on both the language and the mathematics content, which is related to the Content-and-Language Integrated Learning (CLIL), an educational model introduced by Dalton-Puffer (Veloo, et al., 2015). CLIL involves content-based instruction whereby learners are immersed in an immersion context of education that focuses on language and content. CLIL has many similar characteristics with other types of bilingual educational models, such as content-based instruction (CBI) and immersion education (Wahab, et al., 2016). As with the case of mathematics teaching at the *Orang Asli* primary schools, mathematics teachers would need to deliver their mathematics lessons in the formal interaction language (Bahasa Melayu) and at the same time, they would need to explain the mathematics content in the *Orang Asli* language (Bahasa Temiar). This is in line with CLIL as it depends much on the cultural frame of reference and lessons that are part of the learners' everyday school experience. Hence, the mathematics lessons would be well-embedded within the culture of the *Orang Asli* pupils with a high degree of familiarity for them. The pupils'would be able to comprehend the discourse of the mathematics classroom, which could provide them with a mental schema or discourse domain for confronting with particular, but familiar situations (Gersten, et al, 2005).

The objectives of this study, therefore are to investigate Grade 5 *Orang Asli* pupil's achievement based on Bahasa Melayu and Bilingual versions of Mathematics test. This study also compared *Orang Asli* pupil's achievement in computation and word problem items. It is a common knowledge that the purpose of education is not to only guide learners to perform well in assessments but more importantly to also educate them to survive in real life situations and solve real-life problems. However, when pupils only show minimal performance in their assessments, they are most likely not to be ready and competent to confront challenges in their everyday life. Thus, it is the responsibility of all parties especially educators to enhance pupils' learning significantly (Gooding, 2009).

1.3. Conceptual Framework

In the current study, the Mathematics Grade-5 Competency Test (MGCT), which consists of two papers, namely Paper 1 and Paper 2 were used to determine the *Orang Asli* pupils Mathematics achievement. Paper 1 measures Mathematics computation items and consists of 30 Multiple Choice Item (MCI) while Paper 2 measures Mathematics word problems and comprises of 20 MCI. Both papers 1 and 2 are in Bahasa Melayu and Bilingual (Bahasa Melayu and Temiar language). Papers 1 and 2 consist of three main topics – *Operation on Numbers*, *Money* and *Time*. Overall, the *Orang Asli* pupils' performance on the computation and word problem items from the topics *Operation on*

Numbers, *Money* and *Time* was investigated through 50 MCI distributed across seven topics. The topics were extended from the Standard Document of Curriculum and Assessment (DSKP) (Malaysia, 2012) as well as based on the Model of Essential of Numeracy for All. Figure 1 displays the conceptual framework for this study.

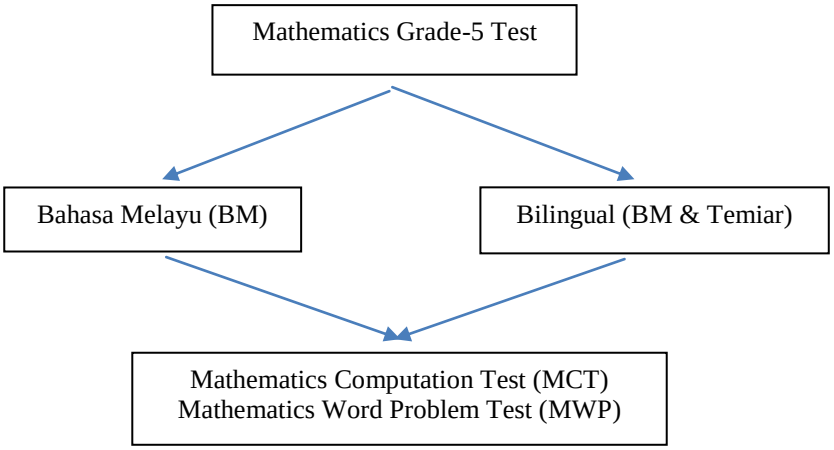

Figure 1. Indigenous (*Orang Asli*) Pupils' Performance Using Bahasa Melayu and Bilingual Version Tests for Mathematics Computation and Word Problem Items

2. Method

2.1. Research Design

This study adopted the quantitative research approach where the two test books were administered in an alternating manner and the scores were aggregated according to the two types of items (computation and word problem). Only the Malay language (national and academic languages) and the Temiar language (native language) were used in this study since these two languages were primarily used as the languages of instruction in the mathematics classes.

2.2. Population and sampling

This study involved eight *Orang Asli* primary school pupils in the district of Sungai Siput, in the state of Perak, Malaysia. The total number of Grade 5 pupils selected for the current study was 287. However, only responses from 230 Grade 5 pupils were analysed.

2.3. Mathematics Grade-5 Competency Test

All the 50 MCI were constructed in two languages, which were Malay and Bilingual (Malay and Temiar) languages, whereby the Temiar language is the Orang Asli language in the oral form. In order to produce the oral form of the Temiar MCI, the Malay language of the MCI was translated by experts into the Temiar language and then audio recorded by the researchers. This test was administered to all the Grade 5 pupils at all the selected eight schools. The pupils were not allowed to use calculators when answering both papers. Prior to the test administrations, they were randomly assigned into two groups, based on the Grade 5 class name lists provided by the school administrators, whereby one group answered in the Malay language and the other group answered the Bilingual test (Bahasa Melayu and Temiar language) for both computation (Paper 1) and word problem (Paper 2) tests.

Item with a difficulty index below 0.30 was classified as a more difficult item and item with a difficulty index above 0.70 was considered as an easier item. Items that have difficulty index between

0.30 and 0.70 were considered to have a moderate level of difficulty, which is applicable for validity (Kaplan & Saccuzzo, 2001).

3. Results

3.1. BM and Bilingual Versions of the Mathematics Grade-5 Competency Test

In this study, the Mathematics Grade-5 Competency Test (MGCT), which consists of computation test and word problem test, were given in two versions, namely the BM version and the Bilingual version.

Table 1 shows that the difficulty index for the BM Computation test was 0.32, indicating that only 32% of the *Orang Asli* pupils had successfully answered the test items compared to 68% who had failed to correctly answer the test items. For the word problem items, the difficulty index was 0.29, indicating that only 29% of the pupils were able to correctly answers the test items compared to 71 % who were unable to do so (Table 1).

The difficulty index for the Bilingual Computation test was 0.39, which shows that only 39% of the Orang Asli pupils had managed to correctly answer the test items compared to 61% who had failed to correctly answer the items. For the Bilingual Word Problem test, the difficulty index was 0.34. Thus, only 34% of the pupils had answered the items correctly while 66% had failed to answer the items correctly (Table 1).

The computation tests in both BM and Bilingual versions were easier for the pupils compared to word problems. Only 31% Grade 5 pupils were able to answer the BM version of the computation test and 37% were able to answer the Bilingual version. Hence, it can be deduced that the Bilingual version of the computation test was easier for the pupils (Table 1).

Table 1. Difficulty index for the BM and Bilingual versions of the Mathematics Grade-5 Competency Test

Test	Items	p	Average for p
Bahasa Melayu (BM)	Computation	0.32	0.31
	Word Problem	0.29	
Bilingual (BM and Temiar)	Computation	0.39	0.37
	Word Problem	0.34	

3.2. Performance in the Mathematics Grade-5 Competency Test

From a total of 222 *Orang Asli* pupils who sat for the MGCT, 114 sat for the Mathematics Computation test while 108 sat for the Bilingual Computation test. Table 2 shows that the percentage score for BM Computation test was 32%, which is lower compared to the score for Bilingual Computation test (38%). Hence, the average score for the BM and Bilingual Computation test was 35%. On the other hand, the average score for BM and Bilingual Word Problem test was 29.5%.

Table 2 also shows the pupils performance in both versions of MGCT. In can be seen that the pupil's performance in the BM and Bilingual version of the computation test was higher (35%) than their performance in the BM and Bilingual version of the word problem test (29.5%). Thus, it is conjectured that the Orang Asli pupils' performance in the computation test was better than their performance in the word problem test (Table 2).

Table 2. Pupils performance in MGCT according to test versions

MCT	Test Version	No of Students	Total Score	(%)	Average
Computation	BM	114	3600	32	35.0
	Bilingual	108	4110	38	
Word Problem	BM	116	3215	28	29.5
	Bilingual	104	3185	31	

4. Discussion

4.1. BM and Bilingual Versions of the Mathematics Grade-5 Competency Test

There is evidence in our study to indicate that the bilingual version of computation test was easier for the Orang Asli pupils, a finding which is in line with the findings whereby the students in their study showed better mathematical knowledge when the examination was in the oral mode compared to their performance in examinations given in the written mode (Videnovic, 2017). The findings in our study also supported the findings that the Indigenous pupils only performed moderately in numeracy competency test that was administered in the written form compared to their better performance when the test was given in the oral form. The oral mode of the examination had contributed to the Indigenous pupils' mathematics performance. The ability of the Indigenous pupils to perform better in the oral mode of the examinations provided evidence of a possible link between language and test performance, with test delivered in the oral mode having the potential to support *Orang Asli* pupils' mathematics performance (Ismail, et al., 2020). Hence, it can be construed that language is one fundamental factor that affects *Orang Asli* pupils' mathematical knowledge and understanding. It would indeed be an advantage for the Indigenous pupils if they are taught mathematics by Mathematics teachers, who know the pupils' first language (Wahab, et al., 2016). Teaching of mathematics in the *Orang Asli* primary schools apparently needs to focus on both the language and the mathematics content, which form the backbone of the Content-and-Language Integrated Learning (CLIL) (Dalton-Puffer, 2011).

Mathematics items often involve multiple skills, which pose a considerable challenge to pupils who have not mastered the fundamentals of the subject (Retnawati, et al., 2017). We infer from our findings in the current study that the *Orang Asli* pupils' performance in the computation test is better than their performance in the word problem test, which pose a considerable challenge to pupils, who have not mastered the basic concepts (Retnawati, et al., 2017). The findings identified several mathematics-related difficulties such as reading and comprehending word-problems, writing a number sentence, carrying out the calculation, which includes using the accurate methods (Gooding, 2009). Apart from pupils low levels of absolute and marginal learning, there was also the challenge of students being incapable of answering primary level numeracy problems such as *Whole Numbers*, *Fractions*, and *Decimals* (Beatty, et al., 2018; Pritchett, 2018). With local national primary school pupils' performance in Mathematics ranging from low to medium (Tanius, et al., 2018). Indigenous students need to step up and be competent in performing basic mathematical operations because these basic numeracy skills can be applied in their everyday living (Sabidin, et al., 2017). This study also supports that symbols were easier for the *Orang Asli* pupils to comprehend when compared to mathematics word problem solving items. This shows that students' mathematical understanding can be better enhanced when symbols are used (Veloo, et al., 2015).

5. Conclusion

Overall, the *Orang Asli* pupils in the current study performed better in computation items and word problems when they use Bilingual version of the test compared to the Bahasa Melayu version. This seems to point to the need to use native language in the teaching and learning of Mathematics in the *Orang Asli* primary schools because it supports their mathematics learning and has the potential to increase the *Orang Asli* pupils' performance in Mathematics. Thus, it is conjectured that the Orang Asli pupils' performance in the computation test is better than their performance in the word problem test. Finally, as evidence from the findings of the current study, it will indeed be worthy for the mathematics educators in the *Orang Asli* primary schools to consider these findings and better understand the learning and teaching of Mathematics computation and word problem items within the context of the *Orang Asli* primary schools. It is also hoped that the findings will contribute to actions taken by other educators and researchers towards the enhancement of mathematics competency among the *Orang Asli* pupils and perhaps consider oral native language assessment as a promising future alternative in testing.

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