

DESCRIBING DIFFERENT STRATEGIES THAT LIE BENEATH TOWARDS SOLVING DIFFERENT FORMS OF WORD PROBLEMS AND DESCRIBING THE ANALYSIS OF STUDENT DIFFICULTIES IN SOLVING MATHEMATICS PROBLEMS IN HAJI MOHAMMAD JAAFAR MAUN KIULAP PRIMARY SCHOOL IN BRUNEI DARUSSALAM

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Abstract

This paper sets out to see how the Mathematics teachers in Haji Mohammad Jaafar Maun Primary School in Brunei Darussalam put literacy and numeracy guidelines for teaching Mathematics into practice. The study aims to describe different strategies that lie beneath towards solving different forms of word problems and describe the analysis of student difficulties in solving Mathematics problems. The research instruments used a school-based assessment (SAT); this included an evaluation of the students' work and interviews from students and teachers. The participants were lower and upper primary students of the academic year 2019 from Year 1 to Year 5 which amounted to 135 people; the teachers were eight Literacy and Numeracy teachers. The results showed that the student difficulties were mostly understanding knowledge in real-life contexts and understanding appropriate mathematical language through open-ended questions. The different strategies used are (1) giving real-life examples, (2) question-answer technique, (3) peer learning technique and (4) activities and games. And student difficulties in solving Mathematics problems are (1) reading text difficulties (2) unfamiliar contexts in problems, and (3) using inappropriate strategies.

Keywords: mathematics pedagogy, word problems, primary students, mathematical language, school-based assessment, vocabulary

1. INTRODUCTION

Brunei Darussalam's national education system emphasizes on quality education and this includes investing in early childhood and lifelong learning to prepare the students with necessary skills and to provide employability while facing 21st Century challenges (2019). Brunei Darussalam's current education system is called National Education System for the 21st Century or Sistem Pendidikan Negara Abad ke-21 and its acronym is called SPN21 (Ministry of Education, 2019). Since its introduction in 2007, the system had gone through major changes in various stages of implementation. The main goal of the SPN21 is to serve a national vision which is called Wawasan Brunei 2035. In order to achieve the national vision, the education mission is to provide holistic education to every citizen. One direction is to improve students' achievement and to increase the students' enrolment at higher institutions (Ministry of Education, 2019).

The Ministry of Education (2017) had introduced four mandates: the implementation of the teaching for English Literacy and Mathematics Mastery Frameworks; the alignment of the Teacher Professional Development Framework with the Teaching for English Literacy and Mathematics and Mastery Framework; the sharing of relevant data and continuous monitoring of the implemented programmes. The objectives of these four mandates were to promote and improve teachers' pedagogical practice and to identify and address students' proficiency level.

The teachers in Haji Mohammad Jaafar Maun Primary School had undergone a literacy and numeracy professional development programme in which they intensified their pedagogical practices and deepened their content knowledge. The teachers imparted their knowledge by engaging learning skills such as problem-solving, critical thinking and reasoning to the primary students. Furthermore, communication is an essential tool (Jung & Reifel, 2011) as teachers must know what makes Mathematics work and explicitly teach and encourage their students the development of mathematical thinking. Teaching and learning the language of Mathematics is vital for the development of mathematical proficiency because the students' mathematical vocabulary learning is of great consequence in their language development and eventually mathematical proficiency (Riccomini, Smith, Hughes & Fries, 2015).

Although there was a great emphasis on learning mathematical thinking skills in primary Mathematics curriculum, to a great degree the Mathematics achievement of students was far from being exemplary. The evidence for this underachievement can be found in school-based assessments (SBA) which were conducted throughout the year in Haji Mohammad Jaafar Maun Primary School.

Due to the less favourable outcome, it could be inferred that the teachers must take on different strategies in implementation of tasks. Thus, in this context, the study focused on the subject of teaching strategies used by Mathematics teachers and on the student difficulties which the students encountered in real-life contexts and in understanding by promoting appropriate mathematical language through open-ended questions.

2. OBJECTIVE AND SIGNIFICANCE

The objectives are to describe and identify the different strategies used by Mathematics teachers in implementation of tasks, to underline the difficulties the students faced and to promote mathematical language through open-ended questions.

The significance is that the classroom is a very special learning environment for relationships between students and between the teacher and the students. Thus, this relationship becomes fundamental in the development of the learning process of the students and the teaching of the teachers. By regularly monitoring the interactions which happen in the classroom, the sharing of ideas and clarification of mathematical thinking and understanding take place and stimulate exploration in the world of Mathematics.

3. LITERATURE REVIEW

The literature describes views on mathematics language, teaching strategies and student difficulties concerning Mathematics education.

Mathematics language includes vocabulary, syntax, symbols, and written and spoken forms (Heller, 2015). Students need to learn relevant mathematics language and to appreciate how terminology relates to daily usage. Strategies such as vocabulary activities, use of dictionaries and use spoken words and written forms in class as to support the language development (Heller, 2015). The teacher's view, behaviour, teaching strategies and subject knowledge determine how much students learn, and how students' belief and behaviour towards the teacher and towards Mathematics (Kiwanuka, Van Damme, Van Den Noortgate, Anumendem, Vanlaar, Reynolds & Namusisi (2016).

The main role of a teacher is to impart knowledge, arrange classroom instruction, make decisions, identify and perceive about Mathematics teaching and learning, and help students to master learning difficulties they face with mathematical concepts by using a wide variety of teaching techniques such as using real-life examples, using question and answer technique, visual examples, storytelling, singing songs, using peer learning technique, having discussions and using analogy and explanation to strengthen and build connections between students' prior knowledge and what they need to know (Kiwanuka, Van Damme, Van Den Noortgate, Anumendem, Vanlaar, Reynolds & Namusisi (2016).

4. METHODOLOGY

This study aims to investigate the teaching strategies used by the Mathematics teachers in solving different forms of word problems and to investigate the student difficulties in solving Mathematics problems.

4.1 Participants

The participants were 135 primary students and eight literacy and numeracy teachers at Haji Mohammad Jaafar Maun Primary School.

4.2 Data Collection

The data was collected in each classroom of the Mathematics teachers. The teachers implemented a school-based assessment taking into account the objective of this study; the method used is qualitative where it consists of an analytic and expository study.

An interview guide was prepared and later revised; the questions contained open-ended and in-depth questions about the teacher's perception on description of the examined questions and on experience with relevance to specific Mathematics language. The questions were also used as a starting point for further discussion.

The questions were applied to three participants as a pre-test and then the questions were revised and confirmed before the actual interviews took place. The teachers' interviews were a five-minute long and the students' interviews were a minute long. The interviews took place in classrooms and staffrooms. Each interview was audio-video recorded and was later transcribed. The participants were reassured that their given information would be kept confidential.

Each class completed an assessment and the assessment was a standardized pencil-and-paper instrument. Each student's mark was calculated and changed to a percentage. The average per-class accuracy would be the percentage of each student which was added together with other students and then the total was divided by the number of students of the stated class.

4.3 Data Analysis and Interpretation of Data

4.3.1 Age and Gender

The information with regard to the age and gender is given in table 1.

Table 1: Age and Gender

	Age	Gender (M/F)		Boys (%)	Girls (%)	Total (%)
Year 1	7	14(M)	16 (F)	47%	53%	30 (22%)
Year 2	8	8 (M)	19 (F)	30%	70%	27 (20%)
Year 3	9	13 (M)	12 (F)	52%	48%	25 (19%)
Year 4	10	15 (M)	13 (F)	54%	46%	28 (20%)
Year 5	11	13 (M)	12 (F)	52%	48%	25 (19%)
		63 (M)	72 (F)	47%	53%	135 (100%)

The information in table 1 shows that there are more female students (53%) than male students (47%). Furthermore, each class has a relatively small overall percentage with one another which ranges from one to two percent.

4.3.2 Teachers' Background

The information with regard to age, gender, the educational level and the number of teaching year of the teachers is given in table 2.

Table 2: Teachers' Background

Teachers	Age	Gender (M/F)	Educational Level	Number of Teaching Year
1	53	F	Teaching Certificate	30 years
2	49	F	B.Ed in Primary Education	27 years
3	49	F	B.Ed in Primary Education	27 years
4	39	M	Diploma in Education	17 years
5	40	F	B.A. in Primary Education	17 years
6	37	F	Diploma in Education	16 years
7	33	F	M.A in Education Visual Art	5 years
8	27	F	B.A in Science Education	1 year

The information in table 2 shows that the age of the teachers ranges from 27 to 53 and there are more female teachers (87.5%) than male teachers (12.5%). There are four teachers (50%) hold an undergraduate degree, two teachers (25%) hold a diploma, one teacher (12.5%) holds a teaching certificate and one teacher (12.5%) holds a master degree. There is a 17.5% average teaching experience from the number of teaching year. From this given information, it may be concluded that there are more long-serving female teachers who taught more than ten years and more, and there are three non-Mathematics teachers from the teachers' category.

4.3.3 SBA Results for Lower Primary Students

This table 3 gives information on lower primary students' pre-test, review 1 and review 2 of each academic year.

Table 3: SBA Results for Lower Primary Students

Test	Year 1 Pass %	Year 2 Pass %	Year 3 Pass %	Overall Pass %
Pre (January)	22% (6/27)	61% (16/26)	24% (6/25)	36% (28/78)
Review 1 (March)	52% (14/27)	73% (19/26)	48% (12/25)	58% (45/78)
Review 2 (August)	78% (21/27)	92% (23/25)	74% (20/27)	81% (64/79)
Overall School Target 60%				Achieved

This table 3 shows that Year 1, 2 and 3 students sit for their tests thrice a year. The result from pre to review in each academic year shows that there is a steady increase in the number of passes; the overall school target has also been achieved and it has clearly exceeded by 21%.

4.3.4 SBA Results for Upper Primary Students

This table 4 gives information on upper primary students' pre-test, post 1 and post 2 of each academic year.

Table 4: SBA Results for Upper Primary Students

Test	Year 4 Pass %	Year 5 Pass %	Overall Pass %
Pre (January)	7% (2/28)	12% (3/25)	10% (7/72)
Review 1 (March)	35% (10/28)	16% (4/25)	25% (18/72)
Review 2 (August)	72% (21/29)	28% (7/25)	52% (37/54)
Overall School Target 60%			Not achieved

The information in table 4 shows that students have sit thrice a year for their pre to review tests. There is also a steady increase of passes from pre to post; however, the overall passes at the end of the second post show that the students fail to achieve the overall 60% school target. The target percentage is short by eight percent.

4.3.5 Students' Views on their Mathematics' assessment

The following entries are the primary students' views on their assessment.

Table 5: Students' Views on their Mathematics' assessment

Students	Views
Student 1:	<i>I have to think carefully before I answer.</i>
Student 2:	<i>I found paper 2 difficult because in a mixed four question, I must choose and answer the first question.</i>
Student 3:	<i>I get confused with some words.</i>
Student 4:	<i>I must do better because Maths is important.</i>

Student 5:	<i>I find it challenging.</i>
Student 6:	<i>I count correctly and it is easy to answer questions.</i>
Student 7:	<i>I like Maths because I want to work in a bank.</i>
Student 8:	<i>I prepare and learn how to do the working.</i>
Student 9:	<i>I want to get a high mark. I study every day.</i>
Student 10:	<i>I don't know what take away means.</i>
Student 11:	<i>Maths is fun. I learn Maths by memorising the formulae and steps.</i>
Student 12:	<i>Maths is fun and I like Maths.</i>
Student 13:	<i>I don't understand steps.</i>

The entries in table 5 are evident that students have strong beliefs about Mathematics, and have both positive and negative attitudes towards their Mathematics' assessment. Having a purpose on the importance of learning Mathematics is useful and practical despite it is a demanding challenge and can confuse students while learning Mathematics.

4.3.6 Teachers' Views on their students' assessment

Only five teachers have returned the questionnaire.

4.3.6.1 What common reasons do teachers face looking at their students' results?

Table 6: Teachers' Views on their students' assessment

The following comments are noted:

Teachers	Comments
Teacher 1:	Recently my Year 4 students were involved with the preparation of a state event and the rehearsal took a month. My students had missed several sessions since they had to leave by 7:30 am. So their performance was not at their best.
Teacher 2:	Students sometimes were naughty and left their seats. While being disciplined, they lost precious time learning what was taught. Thus, they didn't fully understand at the end of the lesson and this caused them not to complete their assessment.
Teacher 3:	The students didn't revise properly and if they did revise, I won't be surprised that they revised last minute. Many students did not bother to pay attention in class and they missed what was explained on that day.
Teacher 4:	Teachers didn't finish teaching the topic. Of course, the students couldn't answer the question.
Teacher 5:	Students in Year 1 are not ready with Maths language and they are unable to visualize what the questions mean to solve problems.

The entries in table 6, although the teachers have their own opinions, their opinions shape their behaviours and beliefs on the attitudes of their students. One comment is teachers are negligent about completing a topic or more. From not ready to ill-preparation to less attentive in class, these reflect the performance of the end results. However, the main reason lies in the students' ability to prove a good understanding of the basic concepts of Mathematics.

4.3.6.2 What pedagogical tactics do teachers use in helping the students to improve their results?

Table 7: Teachers' Comments on pedagogical tactics to improve students' results

The following comments are noted:

Teachers	Comments
Teacher 1:	Fun learning such as games, role play, sing songs and continue with the morning intervention sessions.
Teacher 2:	Allow my students to explore, especially with hands-on activities and use concrete materials.
Teacher 3:	Use a real-life example such as selling ice-cream during a hot day. This works well with addition and subtraction.
Teacher 4:	Arouse interest by watching a short educational video, for example.
Teacher 5:	One-to-one with the student and explain carefully.

The entries in table 7 show a variety of responses from learning in a fun way to having a one-to-one discussion. Teachers make deliberate effort to help their students and use strategies to engage their students in meaningful learning.

4.3.6.3 What are your thoughts regarding the design of the school-based assessment?

Table 8: Teachers' Opinions on the design of the assessment

The following comments are noted:

Teachers	Comments
Teacher 1:	The question paper covered many topics and my students did well. The paper was easy, in my opinion.
Teacher 2:	Many scored high marks but some students failed. My students mostly failed on word problem questions.
Teacher 3:	It was a good practice to get the students ready and the questions ranged from difficult to easy.
Teacher 4:	The paper encouraged my students to recall previous taught lessons but some students had forgotten the steps.
Teacher 5:	Many of my students find the paper somewhat difficult because they could not remember what to do. In my view the paper was fair because I did teach all the topics.

The entries in table 8 show that the teachers rate the design of the assessment from difficult to easy because there is a mixed ability group in each class. They also mention that their students fail on word problems and have forgotten how to work out their answers.

5. FINDING

The finding is divided into three sections: mathematical language; teaching strategies used towards Mathematics teaching and learning; and teachers and students' views in understanding knowledge in real-life contexts and in understanding appropriate mathematical language through open-ended questions.

5.1. Mathematics language

Students have difficulty understanding explanation, written instruction and even verbal instruction, and the language problem is in fact come from difficult terminology (Lantolf, Thorne, & Poehner, 2015). But a language development learning disorder such as dyslexia can impact reading, spelling and writing, and be a contributing cause which reading skill is affected (Elleman, Steacy & Compton, 2019).

5.2. Teaching strategies used towards Mathematics teaching and learning

English language teachers work with non-Mathematics teachers on Mathematics vocabulary and discourse. Both non-Mathematics teachers and Mathematics teachers work in teams and practise micro-teaching amongst themselves. They also review each other's teaching session so that they can receive constructive feedback and improvement on their pedagogies. The non-Mathematics teachers are also taught on the use of bar model strategy, in which the strategy solves number problems such as addition, subtraction, multiplication and division, and to solve multi-step word problems before the intervention sessions begin.

The teachers use teaching strategies such as using real-life examples, using visuals and images, using peer-assisted activities and games, providing opportunities by asking the students to explain how they conclude their answers, story-telling, simplifying some difficult words, substituting some figures or data and conducting repetition drills.

A weekly intervention session throughout the whole academic year from 7:30 am to 8 am follows a sequence: Monday is micro-teaching between the teacher and students in which the students are further divided into three groups – low achievers, mid achievers and high achievers; Tuesday is conducting a test; and Wednesday is conducting correction.

5.3 Teachers and students' views in understanding knowledge in real-life contexts and in understanding appropriate mathematical language through open-ended questions

5.3.1 Teachers' views

The teachers view their students are not capable in partaking in demanding mathematical real-life activity as they ascribe some students' difficulty to inherent traits, for example, the students are slow, lazy and other personality traits. Most describe that they lessen the cognitive demand if they notice their students face difficulty. Teachers also explain that the student difficulty is understanding instruction as the students respond disadvantageously to participate. When the teachers go over many topics and open-ended questions in a specific sequence as to get their students ready for succeeding work, thus, when students struggle, teachers blame on the students and comment they could not change about instruction. Instruction in this case is giving a specific task to do. In short, it means when the students face with word problems without a clear instruction, for this reason the students cannot relate the word problems due to a lack of understanding in language. In relation to this deficiency, a recognition in the importance of reading difficulties as a problem of instruction is highlighted by the teachers.

5.3.2 Students' views

Students have expressed that they try not to answer questions impulsively but they do get excited because they find Mathematics fun especially, they are participating in activities and games. They also mention that they cannot remember what they have learned and get confused on the word meaning.

They find Mathematics is important as understanding and knowing Mathematics form the base to explore mathematical concepts and their mathematical reasoning makes deductions and solves problems; the importance in learning Mathematics is to develop useful skills for future employment, for example, a student exclaims that he/she wants to work in the bank.

With regard to mathematical reasoning, students are able to use mathematical concepts and skills to explain and resolve problems in both unfamiliar and familiar situations which include those in real-life contexts. However, when the students have the appropriate strategies, they may choose not to use them. These are due to misjudge in a word problem or a number problem as being less significant and some students appear as passive learners and they execute the problems in compliance with their teacher request.

6. DISCUSSION AND CONCLUSION

Traditionally Mathematics teachers focus on teaching content; however, nowadays the Ministry of Education,

Brunei Darussalam has introduced four mandates on literacy and numeracy programmes which they are more inspiring and exciting in encouraging educators to enhance and expand their instruction to promote students' mathematical thinking skills. In order to do this, instruction heavily depends on learning to communicate constructively about Mathematics and also to build the teachers' beliefs about Mathematics.

How teachers arrange classroom instruction is based on what they know and believe about Mathematics and on what they identify and perceive about Mathematics teaching and learning. Teachers with in-depth pedagogical content knowledge have clear ideas about how to construct procedural proficiency and how to expand and test learner ideas; teachers use their knowledge to make decisions and take actions every day in relation to matters which occur as a result of the learning process.

However, if their Mathematics pedagogies lack desirable qualities, the teachers' beliefs will decide how they self-reflect as teachers as well as their teaching pedagogies that they aim to implement in future lessons.

In this study, charged responses from the primary teachers create significant mathematical experience and personal interaction between them and their students. When students receive little or no instruction on how to communicate constructively, it leads to failures.

In spite of the fact that the results support the idea that specific Mathematics language should be understood when learning early numerical skills, Mathematics language should be more thoroughly embedded within the national curriculum. What is challenging is that even though it is a short-term fix that the Mathematics question is simplified by eliminating redundant information, use simple words and add symbols, diagrams or pictures; in some ways it is problematic. Thus, Mathematics teachers need to focus on mathematics vocabulary and discourse. Their students' writing would reflect their mathematical thinking and understanding skills. In relation to this, students should be taught as soon as they begin their formal education and be given abundant opportunities to prepare, practise and learn about Mathematics. After all the young students eventually need to engage with Mathematics language as they will find the language in their examination papers.

Furthermore, teachers prepare examination papers as to evaluate students' success which depend on procedural understanding instead of conceptual understanding (Lockl, Handel, Haberkorn & Weinert, 2016) in which teachers should support examination papers which comprise a balanced in measuring procedural and conceptual knowledge. Assessments in Mathematics learning should not base only on the learners' abilities to emphasise how the processes work but also to understand, infer and connect the facts to other concepts. In short, students have difficulties to connect concepts with reality as they need to know what symbols, for example, represent and as how they remember what a concept looks like. This results that the students take for granted in solving mathematical problems by relying on rote memorization of written or verbal mathematical concepts.

One teaching strategy used in teaching is using real-life examples because the real-life examples are critical in helping students to attain critical thinking and also to show the significance of mathematical concepts during their learning. Teaching aids such as graphs, diagrams and pictures provide students with clear conceptual understanding as well. Another strategy is question and answer technique where classroom oral communication is encouraged (Kaur & Gupta, 2013). This verbal interaction helps to elicit knowledge at conscious level and the teacher must bear in mind to prepare her questions logically, and the language of the questions must be clearly expressed and understood (Kaur & Gupta, 2013).

In addition, the peer learning technique allows students to learn from each other, that is, by explaining their opinions and ideas, and by partaking in activities with their class friends. This gives them the opportunity to work together with others, to obtain feedback from them and to evaluate their learning (Snyder, Sloane, Dunk & Wiles, 2016). This technique also applies to teachers especially during their micro-teaching with their peers. Furthermore, engaging in activities and games provide opportunities to students to explore and discuss mathematical concepts (Dele-Ajayi, Strachan, Pickard & Sanderson, 2019). Activities and games are very effective because they are fun learning and they are not graded as formative assessments!

Given that certain strategies are not ideally taught at their highest quality and that students are in many instances left alone to explore independently, the students often use strategies which do not reach the wanted results. Teachers have no control over their students' entry knowledge but they can take positive approaches in ensuring that their students take steps in adopting appropriate autonomous learning behaviours.

Students with poor number sense who do not enjoy Mathematics will not further explore numbers. They rely on rote memorization which they feel secure with, and on applying procedures, with little understanding of

the fundamental numerical concepts (Shumway & Moyer-Packenham, 2019). Over time through exploration and play with numbers a good number sense will gradually develop (Shumway & Moyer-Packenham, 2019).

Learning Mathematics is thought about as graduating through numerous stages of understanding: from situational to specific phases (Mohyuddin & Khalil, 2016). It requires innumerable practice which results in cognitive processes from low to high. Typically learning Mathematics is categorised as drill and practice because it involves repetition of specific skills and the skills become cognitively building blocks for higher learning and complex tasks (Lim, Tang & Kor, 2012). However, learning Mathematics aims at practice which exceeds mechanized repetition of numeracy skills (Lim, Tang & Kor, 2012).

This study provides evidence to some degree that further studies are needed in the role of selected word problem situation and selected teaching strategies that enable teachers to explore their students' understanding and to expand their own understanding into what their students know so that the teachers can quickly overcome any sudden difficulties which they may face in the classrooms.

7. RECOMMENDATION

Professional development should be an on-going process and long-serving teachers need continuous opportunities to build their understanding and ability by attending refresher courses for mastering new pedagogies. The Mathematics content knowledge is critical and the teachers must engage and share with their colleagues what they have learned from their professional development courses. This also allows them to be more effective and content in many aspects of their work.

Another recommendation is an integrated approach of instruction is to teach mathematical content digitally starting in the primary level.

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