

INVESTIGATING COMMUNICATION IN PRIMARY THREE BRUNEIAN CLASSROOM

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The emphasis on communication is more apparent in mathematics classrooms of recent years as open-ended teaching and teaching via problem solving become more popular. Communication is considered as one of the mathematical processes that need to be inculcated through the teaching of mathematical content in the Bruneian curriculum. The emphasis is stated in the current curriculum document. Communication is a way of sharing ideas and clarifying understanding. When children think, respond, discuss, elaborate, write, read, listen and inquire about mathematical concepts, they reap dual benefits: they communicate to learn mathematics and they learn to communicate mathematically. So how do children in Bruneian classrooms communicate? This report will investigate communication as children in Primary 3 learn about solids. Different representations were used by the teacher to make sure that she communicates meaning to the children to make them understand the topic.

INTRODUCTION

With the adoption of a constructivist philosophy, mathematics educators now advocate more active learning on the part of students and a more facilitative role for teachers. A key component of most new instructional strategies is that students are expected to discuss mathematics with their peers and their teachers (Khalid & Tengah, 2007). The emphasis on mathematical communication creates challenge for both teachers and students. This is especially so when mathematics is taught in a different language than the students' first language. Conveying meaning and making students understand the mathematics that is being taught requires careful planning and a great deal of time on the part of the teacher.

Martin (1996) reported that students in Bruneian classrooms are reluctant to speak in class. According to him, apart from the choral chanting, there is very little verbal output by students in Brunei classroom, which to him is a disturbing feature. In my opinion, students' responses depend on the kind of questions that is being asked, and that depend on the nature of the topic and the objective of the lesson. Success to enhance communication in class depends very much on these three factors:

1. The teacher – The teacher who questions (for example using the phrases with these words: but then, if ... then, in that case, etc.), encourages, interrupts when necessary, directs and guides students into speaking, and allows students time to reflect.
2. The task – Tasks that are open, requires students to write and present, tasks that are relevant and that is carefully sequenced, tasks given for group work, etc.

3. The classroom environment – The classroom that is non-threatening where teachers and fellow students give support, encourages, cares, helps etc.

Classes having the above features will make students feel confident and not shy to communicate or ask questions.

COMMUNICATION IN THE BRUNEI CURRICULUM

Communication is considered as one of the processes that are supposed to interweave with the teaching of mathematical content (Figure 1). This can be implied from The Bruneian “Mathematics Syllabus for Lower and Upper Primary Schools” (CDD, 2006a; 2006b). According to the document, mathematics provides a powerful means of communication which can be used to present information in figures, tables, charts, graphs and symbols (CDD, 2006, p. 2) and the process of communication is to be developed at the same time with the teaching of mathematics content together with other skills such as mathematical skills and problem solving.

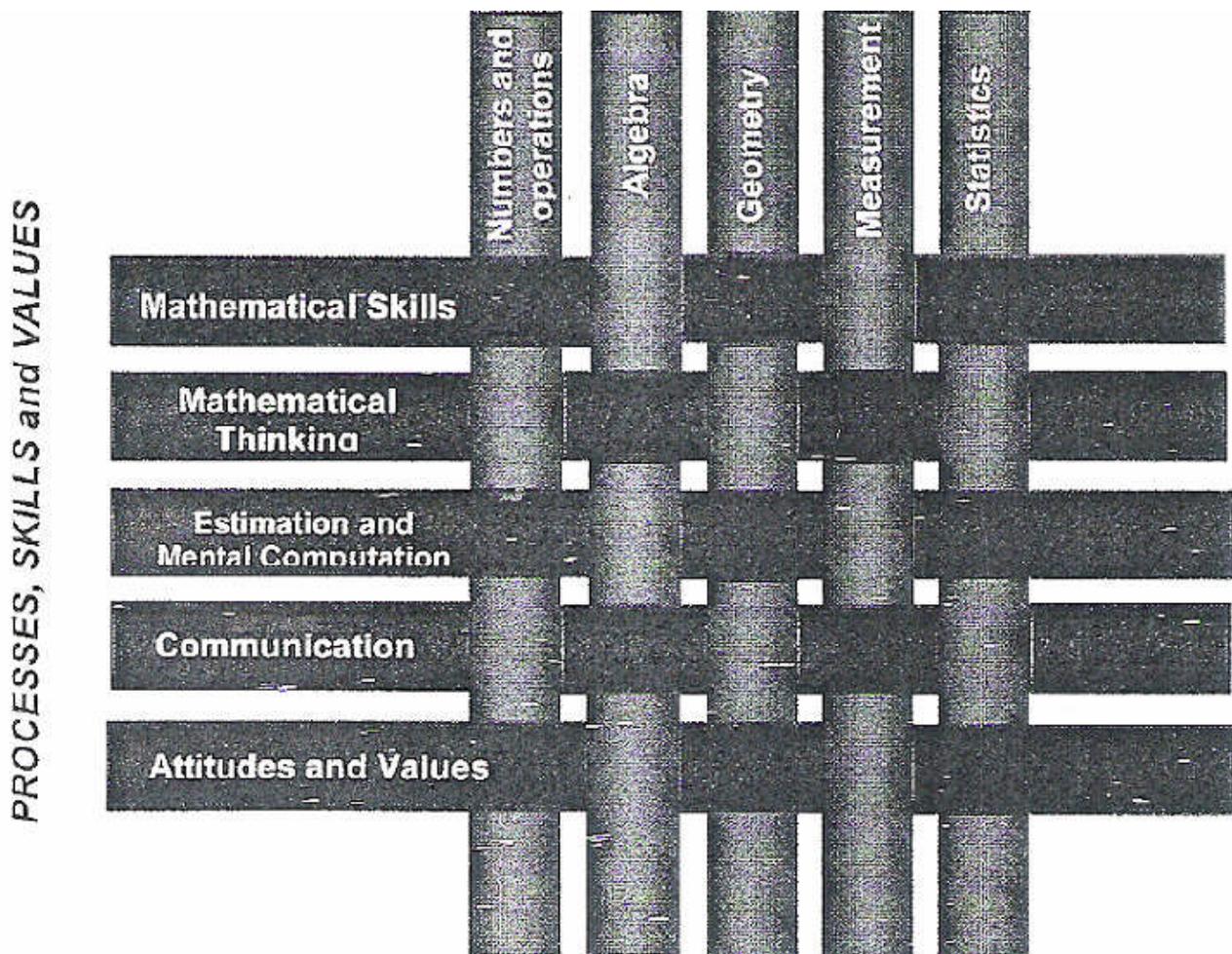


Figure 1: The Conceptual Framework

The mathematics curriculum also listed one of the main aims of mathematics teaching and that is to develop children’s ability to interpret and communicate mathematical ideas. In addition, the document also stated that the main objective of the curriculum is to provide learners with the opportunity to develop the ability to

communicate mathematical ideas clearly and work with others and value their contribution (CDD, 2006, p.3).

The emphasis of communication in the syllabus is also reflected in the suggested assessment and evaluation method. Continuous school-based assessment is supposed to include assessment tasks that have the communication component and are as follows:

- Class discussions or oral presentations
- Written assignments
- Creative work
- Use of ICT

(CDD, 2006, p.3)

As has been reported before, the instructional approach that is stated by the Curriculum document suggests that children should be actively involved in learning mathematics through a variety of representations. Therefore, when planning the lessons for the lesson study research, the suggestions from the document and other sources were taken into consideration.

There are other suggestions for enhancing mathematical communication in class, for example, creating opportunities for students to reflect and argue as was mentioned by Tanaka (2007) and allowing creative experience by Nemoto (2007)

THE LESSON STUDY CYCLE

After starting lesson study with some teething problem last year, I am glad to say that this year's cycle were carried out successfully with more recognition given by the people concerned. This year, thirty teachers from various schools in Brunei were sent by the Ministry of Education to attend a one-day workshop on lesson study in mathematics at Universiti Brunei Darussalam. The workshop was carried out on the 2nd of May, 2008. We have also added another member from our department to our research group. Hopefully, more teachers would implement lesson study at their school after attending this workshop

Earlier, we started our lesson study with a group of six teachers at one of the government primary school in Tutong, Brunei in March, 2008 until April 2008. Out of the six teachers, three were involved in teaching while the other three participated in the observation of lessons and discussion during post-lessons. Each of the teachers had two topics each to teach. The first teacher taught the topic of long division and multiplication to Primary 4 pupils, the second teacher taught Primary 5 pupils the topic of mixed operations and rate. The third teacher taught primary 3 pupils the topic of shapes and solids (or 2D and 3D shapes)

THE RESEARCH LESSON

For the purpose of this paper, I have chosen to focus on one of the research lessons involving Primary 3 children (about 9 years of age). The class comprises sixteen pupils and the topic area of the lesson is solids or 3-dimensional shapes. The main aim of the lesson is for the teacher to introduce solids to the pupils using different representations, as well as identify the number of faces, corners and edges of the solids. Multiple representations are recommended for teaching so that children have better understanding of what is being taught. By using multiple representations, teacher can convey meaning and communicate with pupils in many different ways so that children can familiarize themselves with the shapes and the characteristics of the shapes. The fact that children are learning in English when English is not their first language, makes it more crucial to teach with multiple representations. They had been exposed to shapes and solids the year before but it was taught in Malay. The complete aims stated in the teacher's lesson plan are as follows:

At the end of the lesson, students should be able to:

- 1) identify different basic solids.
- 2) identify the number of faces, edges, and corners of the basic solids.
- 3) communicate their understanding of basic shapes as well as identification of faces, edges and corners with teachers and friend.

Other objectives included in the lesson plan are:

- 1) For students to be interested in the lesson (have the right attitude to be involved in the lesson and communicate)
- 2) For students to relate what they know with what they are currently learning and to make sense of the lesson by communicating with friends and teachers.

LESSON PLAN DEVELOPMENT

The lesson plan for the purpose of lesson study was written by the teacher after discussion with the team. She was determined to make students participate during the lesson because communication is necessary for developing mathematical reasoning. The activities planned were to investigate the characteristics of the solids and then to reinforce the knowledge that was learned. She divided pupils into groups of four so that they can communicate better between themselves. The lesson plan can be examined in Appendix A.

For introduction, the activity she planned was to ask students to make a cube out of a given net. This activity was planned so that pupils are involved in a hands-on activity to make them interested in the lesson. This is considered an important part of the lesson because it dealt with mathematical attitude. It is one of the ways to motivate students, as was mentioned in Keller's (1983) ARCS model where students' attention is gained and maintained by making eager to know what the shape will be. She also planned to ask students to name real-world objects in the shape of the solid. Other solids were introduced by her taking out each object from a bag.

Her second activity with the children introduces the word face, corner and edge and subsequently to count the number of faces, corners and edges of each solid. The teacher was aware of definition for edges and corners and decided to use the word

“consider” to describe them on the cones and cylinders (because on these solids they are not straight line). She planned to show both the real-world examples of the solids and also the geometrical teaching aids (manipulatives) provided by the school.

For her third activity, she prepared diagrams of the solids with arrows pointing to the faces, corners and edges. She also prepared flash cards with the word face, corner and edge for children to choose from and then stick it to the board to identify them. This activity will help student identify correct terms to use on a diagram. She also distributed the different shapes around so that children could examine the solids themselves.

Her final activity is again a reinforcement exercise. She prepared a chart with the names and pictures of all six solids and children were to fill in the number of faces, corners and edges of each of these solids. Children are supposed to come forward and volunteer their answers.

Lastly, she would recap her lesson by asking the children what they have learned that day and reviews about the names of the solids as well as faces, corners and edges.

It could be observed that in the lesson, she had planned to use multiple representations such as concrete, diagram, real-world, verbal and symbolic.

LESSON OBSERVATION AND COMMENTS

Below are the comments on the implementation of the lesson based on the observation data that was collected. I will try to identify the elements of communication that are present during the lesson.

The teacher attempted to present the lesson in a manner that the children would actively get involved and be interested in the lesson. Some of the pupils were eagerly trying to fold and find out the shape of the solid, directed by other friends. However, it was observed that some were not actively involved. Since there are four pupils in one group, it would have been better if two nets of solid were given. Then, the children can work in pairs at that stage to come up with the required solid. Almost all pupils could name the solid when asked. She tried to connect the lesson to the real-world by asking the children to name other shapes that they have seen that is in the shape of a cube. She then took out other solids from her mystery bag and asked the children to name the solids. She asked children to spell the names of the solids and wrote it down herself so that children would recognize the names of the shapes in symbolic representation. Since the children had learned about solids the year before in Malay, it is important for her to do so because the Malay spelling of the solids is different although they sound the similar – kiub, kuboid, kon, silinder, sfera, pyramid. She did allow some time for the children to reflect upon to remember the names of the solids.

The children were quite unfamiliar with the word face, corner and edges because they sound totally different in Malay. Therefore, she insisted that the children touch the faces, corners and edges when they are counting them. The class spent some time

counting the number of faces, corners and edges to make sure the children get it. Children are not sure when asked how many edges a cone has. The teacher responded by saying “consider” this (as she pointed to the curved edge) as the edge because she did not want to go into something as technical as definition. However, the pupils get the idea when they are able to give the correct number of edges of a cylinder.

In the third activity, the teacher tried to bring in the diagram representation, to make sure that pupils could still recognize the face, corner and edge of solids in diagrams and symbolic representation. Children were very eager to come forward to answer participate in the activity that she had to count and choose pupils who put up their hands the fastest. However, sometimes, she chose some quiet and shy pupils to answer the question. She controlled her class quite well when the children made too much noise. The children seemed to relate to her very well because she only need to count up to three, or paused and be quiet for a while or clapped her hands three times for the children to keep their noise down. The children did this activity very well. She also passed around the solids to each group so that children could examine and be familiar with the solids and maybe, reflect on the lesson.

The fourth activity is a reinforcement exercise. This is to assess if the children understand and remembered what they have learned that day. Children were supposed to fill in the blanks asking for the number of faces, corners and edges of the six solid that they had examined in that lesson. Again, children were very eager to come forward and participate in this activity. Only the first girl gave a wrong answer to the number of edges of a cube. The children managed to fill in the blanks (answered) in the chart correctly.

Before the end of the lesson, she recapped her lesson by asking the children what they had learned that day. They responded well to the teacher.

During discussion with the team, the teacher was commended on her hard work with respect to the preparation of the lesson. There were more positive comments and only a few comments on how to improve the lesson. The first one regarding the first activity is, she could have given more nets of solids so that no children are idle during the activity. The second is, she could ask questions on reasoning rather than just recall or knowledge. Questions that connect one solid to another like: “What are the similarities/differences between this solid and this solid?”, “What do you notice when two or more edges meet?” etc.

DISCUSSION

It could be seen from the lesson observed that children are eager and would communicate well when the activities in the classroom is interesting and they were given a chance to participate. Teachers could therefore, encourage students by having interesting activities that are well planned and sequenced. It could also be seen from the lesson that the teacher factor that was mentioned above is very important. Teachers who are caring, friendly, encouraging and guiding makes pupils feel at ease. As a result, they respond well to the teacher, want to please her, and at the same time

enjoy the lesson. Teacher should also try to question pupils with questions that can make them think so that they can reason out and communicate their answer intelligently. The questioning techniques can still be improved in the teacher.

The second factor that was mentioned before, the “task” could also be seen to promote pupils to be actively involved. The task given in the example shown, is interesting but was not accompanied with questions that may promote mathematical thinking. The nature of the activity can be changed to be more open ended by the right questioning techniques. However, due credit should be given to the teacher for the enormous time that was spent on preparing for this lesson. The tasks were relevant and carefully sequenced.

The third factor is the classroom environment. As can be seen from the video (refer to the accompanying video), the classroom environment was non-threatening. The teacher was encouraging and supportive of the students when the children were doing the tasks. Fellow students also were helpful when their friend was in front answering questions.

Overall, it can be seen that the lesson contains many of the elements that can promote communication in mathematics classroom. The different representations were promoted where possible, there were the element of reflection but very little evidence of argumentation present. Although the lesson was conducted in English and the pupils’ first language is Malay, the children seemed to try their best to communicate in English. Every now and then, we can hear some Malay words uttered by the children. This is understandable since this is still a transition period because Brunei implemented the teaching of mathematics in English for. The children learned mathematics in Malay when they were in Primary 1 and 2 before. Starting this year, all schools in Brunei use English as the medium of instruction right from the lowest level. I think children are flexible enough and they could adapt themselves to new situations very well. Therefore, promoting communication and mathematical thinking should be implemented from very young age.

CONCLUSION

Mathematical thinking and communication has been proven to be important and is therefore emphasized in the Bruneian “Mathematics Syllabus for Lower and Upper Primary Schools”. The success for implementing and promoting mathematical communication can be enhanced once teachers are convinced of its benefit and are willing to create classroom situations that can promote it. The focus of six different representations as in the curriculum (CDD, 2006a; 2006b) will give teachers opportunity to communicate meaning and make students understand better. This, together with suggestions for reflection and argumentation by Tanaka (2007) and Nemoto (2007), can enhance mathematical communication in classrooms. It is important that teachers are fully equipped with the knowledge and know-how in order to realize the aspirations of the “21st Century National Education System” (SPN 21) (MOE, 2007).

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Lesson Plan

Name of Teacher: Mazura Johari

Class: 3A

Topic: Shapes (Faces, corners and edges).

Learning Objective:

- 4) For teacher to introduce basic shapes and solids using different representations.
- 5) So that pupils would be able to identify basic solids.
- 6) So that pupils would be able to identify the number of faces, edges, and corners of the basic solids.
- 7) So that pupils would be able to communicate their understanding of basic shapes as well as identification of faces, edges and corners with teachers and friend.

Other Objectives:

- 1) For students to be interested in the lesson (have the right attitude to involve in communication)
- 2) For students to relate what they know with what they are currently learning and to make sense of the lesson by communicating with friends and teachers.

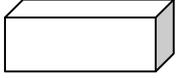
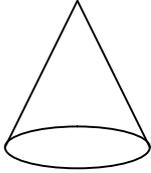
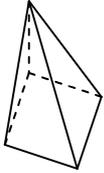
Teaching Aids:

1. Geometric solids: cube, cuboid, cone, cylinder, sphere, hexagonal prism, triangular prism and pyramid
2. Box, tissue box, ball, party hat, hexagonal and triangular prism chocolate boxes, cylindrical containers and picture of pyramid
3. Picture flashcards: cube, cuboid, cone, cylinder, sphere, pyramid, hexagonal and triangular prisms.
4. A chart (see appendix A)
5. Word flashcards: face, corner and edges.

Stage	Materials/Content	Teacher's activity	Pupil's activity
1. Set induction (10 mins)	Students to form a cube from net. Material: Net of a cube	1. Students are divided into groups of 4 2. Each group is given a net of a cube and they are instructed to fold and form a cube 3. Teacher will ask: a) What shape is it? b) Give examples of any objects that is in the shape of a cube	Pupils are expected to do the activity (form the cube) and answer teacher's questions.

<p>2. Development stage (30 minutes)</p>	<p>Identifying faces, edges and corners</p> <p>Material: A box, tissue box, cylindrical container, party hat, ball</p>	<p>4. Teacher shows all shape and ask these questions when each shape is shown:</p> <p>a) What shape is this?</p> <p>b) Come forward and count the number of faces, corners and edges. How many faces does this shape has? How many edges? How many corners?</p>	<p>Pupils are expected to go in front and point and feel the shapes or run their fingers and hands on the edges, faces and corners and answer teacher's questions</p>
	<p>Reinforcing knowledge</p> <p>Material: Picture Flash Cards Word flash cards – face, corner, edge</p>	<p>5. Teacher sticks a picture of each shapes already introduced and ask pupils to come forward to identify the face, corner and edge of each face</p>	<p>Pupils are expected to identify and name the parts of each solid.</p>
	<p>Students to feel and be familiar with the solids introduced to them</p> <p>Material: Geometric solids</p>	<p>6. Teacher distributes 8 different solids (2 to each group).</p> <p>7. Teacher instructed pupils to feel and examine the solids and then identify the number of faces, corners and edges of each solids</p> <p>8. Students will then be asked to exchange solids between each groups so that they can examine all solids.</p> <p>9. Teacher sticks a chart (see appendix A) and ask children to come forward to fill in the chart.</p>	<p>Pupils are expected to examine the solid and identify their faces, corners and edges.</p> <p>Pupils write the number of faces, corners and edges on the chart</p>
<p>4. Closure (10 mins)</p>	<p>Recap lesson</p>	<p>10. Teacher asks what solids they have learn today as well as their number of edges, solids and faces</p>	<p>Pupils respond to teacher</p>

Appendix A

Solids	No. of faces	No. of corners	No. of edges
1. Cube 			
2. Cuboid 			
3. Cylinder 			
4. Cone 			
5. Sphere 			
6. Pyramid 			

Appendix B (Video Description)

Title: Solids

Teacher: Mazura Johari

Class: Primary 3

School: Sekolah Rendah Muda Hashim

Date: 14th April, 2008

Introduction

The lesson was on the topic of solid (3D shapes). The teacher planned the lesson very well, laboriously prepared the teaching aids, determined fully the procedures of her teaching and prepared interesting activities. Since one of the aims of the lesson was to emphasise on communication, she has also prepared to ask appropriate questions to students directly to elicit responses from pupils in the classroom, where understanding can be interpreted from the communication between the teacher and pupils. Pupils were divided into groups of four for the same purpose. Students respond well to her. From other observation that that been done before in this class, I found the teacher to be very well-organised and she set rules that the students abide to. One of the rules is students have to put up their hands if they want to speak in class.

In the introduction of the lesson, the teacher employed a hands-on activity to get the pupils involved. Each group of pupils was given a net of a cube and the pupils are supposed to work together (folding etc.) to form a cube. Pupils were expected to communicate with each other for this activity. However, some of them did not seem to be interested in it because one net to four students is not enough. It might have worked if two nets were given and children would work in pairs. Once they get the shape, the teacher asked them to name the shape. Students were asked to name any object that they have come across before that is in the shape of a cube (real-world representation?).

Activity

Then, the students were shown other shapes – cuboid, cylinder, cone, ball and pyramid (concrete representation) by asking students the name of each shape (verbal representation). They were again asked to name any other real-world objects that are in these shapes and were also shown some of the real world objects in these shapes. She could not find anything in the shape of a pyramid and decided to show a picture of a pyramid instead. Then, pupils were introduced to faces, corners and edges of each solid. They counted the number of faces, corners and edges with the teacher and the whole class by touching them as they do so to make sure that they know the meaning of faces, edges and corners (concrete representation?). This is very important since these words might be new words (terms) to the students.

Then she proceeded to use pictures of these shapes and asked the students to name the faces, corners and edges of each shape (diagram representation). Pupils select the flash cards bearing the words of faces, corners and edges and pasted these alongside the correct arrows pointing to the diagram.

Then the teacher distribute around different shapes to each group (2 to each group) and asked pupils to examine the shapes again and reflect on what they have learned about the shape (reflection).

When the children finished examining the shapes, they were asked to exchange the shapes between the groups so that each pupil has enough time to examine the shapes and to reflect on what they have learned.

After this, to assess pupils' understanding, she put up the chart as shown in the appendix A and asked pupils to volunteer to come forward to fill in the blanks on the chart. Students were allowed to count the faces, corners and edges again if they are not sure of the answer. The children actively participate and were eager to be chosen to answer the questions. They eagerly put up their hands to be called forward. However, a few children still make mistakes, not quite sure of the number of edges (or maybe what edges are).

Conclusion

Finally, she recapped her lesson by asking the pupils what they learned about that day. The responses that she received were encouraging. On the whole, in my opinion, the class was successful. Children enjoy the lesson and learned something that day.