

**A Paper Presented at the 2005 National Curriculum Reform Conference Sustainable Curriculum  
Development – The PNG Curriculum Reform Experience**

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**The role of local language in teaching mathematics in Bridging Class (Grade 3) in  
Papua New Guinea.**

**Section One: Introducing the Study**

**1.1 Introduction**

Most commonly, knowledge is perceived to be constructed personally and is an individual possession (Von Glaserffeld,1995). To think this way does not do justice to the potential of human knowledge which could also be shared through communication in situations such as schooling and become group possession (Mercer,1995). If learning is perceived only as a personal cognition development, it would deny the important role of teaching and hence the language used by the teacher in the communication process that enhance learning (Vygotsky,1986). According to Mercer (1995), teachers and their teaching play a greater role in initiating and guiding knowledge construction. They use language as the predominant medium to achieve this task.

Language is certainly a vital resource teachers use to communicate important concepts such as mathematics in schooling environment, but it is not

straight forward when they are working within a bi/multilingual classroom. Teachers in many parts of the world find themselves in the classrooms that have students who are bilinguals or multilinguals. This provides many challenge in the communication process, especially in teaching mathematics in a classroom situation. This is the case for many classrooms in Papua New Guinea, because most students come from one of the 800+ languages. Education systems in the world handle such language situation different ways, but the Education System in Papua New Guinea have acknowledged the important role language play in the communication process that initiate and guide learning. Therefore, at a policy level, the government has allowed the 800+ languages, two lingua Franca (Pidgin & Motu) and English to be used for schooling purpose. Within this policy change, it also defines a language practice for Grade 3 and it describes it as ‘bridging’. The bridging programmed defined by the policy promotes the language practice of ‘code-switching’, but emphasis that teachers switch to use the local language of the students as a resource to teach subjects including mathematics, while English is formerly introduced.

## 1.2 PNG Language Policy and Bridging Program

After independence from Australia in 1975, for political reasons the Government of PNG decided that schools would use only English as the language of instruction (Clarkson,1991; Matane,1986). As Clarkson (1991) described, it was not only based on the reason that a common language was needed for the country with diverse cultures and more than 800 languages. But there was also the desire to have access to the small Islands neighbors of the Pacific of which PNG considered itself the natural leader, to continue the strong links to the near ex-colonial power Australia, and to have easy access to western technology. In the recent change in education policy, After the policy change and for the education reform, the new structure included Elementary Schools (Prep, E1 & E2; aged 6-9); Primary Schools (Grades 3-8; aged 10-15); and Secondary Schools (Grades 9-12; aged 16-19). It is within this new schooling structure that the language policy is to operate. The particular change that relates to this study is for Grade 3, the first Grade of the Primary sector in the new schooling structure.

The change in language policy in Papua New Guinea education system is pertinent particular for this Grade 3 at the Lower Primary Schools. The language practice promoted by the policy for this grade is 'bridging' (that's the reason this class is also called

the policy to use only English at school has changed and the government now recognizes the use of 800+ native languages, the two lingua franca (*Pidgin* and *Motu*) and English in schools (Clarkson,1991; Matane,1986; *National Curriculum Statement for Papua New Guinea*,2002).

The language policy varies for each sectors of schooling. To elaborate change for each sector, we consider the structural change of the schooling system, as a result of this policy change and its subsequent education reform. According to *figure 1*, the schooling systems before the education reform were called Community Schools (Grades 1-6; aged 8-13), High Schools (Grades 7-10; aged 14-17) and National High Schools (Grades 11-12; aged 18-19). 'bridging class'), which promotes bi-/multilingual language environment in a single mathematics lesson. The bridging process involves the local language(s) as resource to teach and learn various subjects including mathematics, while English is also introduced formerly. As described in the National Curriculum Statement (2002);

In line with the language policy for the lower primary, students at Grade 3 will begin to learn to speak, listen, read and write in English (referred to as bridging to English) as well as continue to develop their first languages (p.19).

This policy is to complement that was set for Elementary sector. According to the language policy for Elementary sector, the language to be used mostly throughout the three years (Prep1, Grade 1 &

Grade 2) is the local language of the students, but oral English should be introduced during the final

year. As the National Curriculum Statement (2002,) describes;

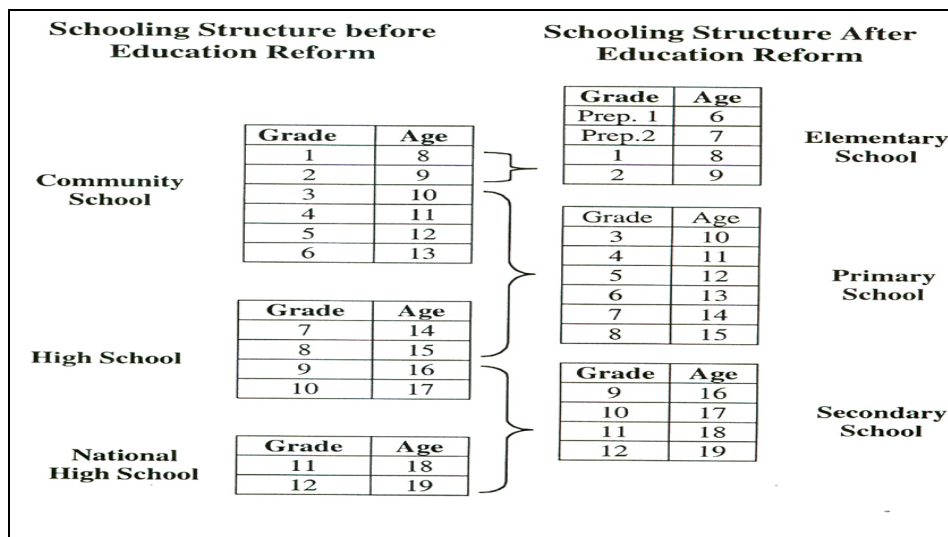


Figure 1.1. The Change in PNG Schooling Structure (Muke, 2001)

The students' vernaculars are the languages of instruction for the first three years of education at the Elementary level of schooling. In line with the language policy for Elementary, oral English is introduced towards the end of Elementary 2 (p. 18).

Since those children that come from the Elementary schools and enter the Lower Primary sector as Grade 3, have used the local language for schooling purpose more frequently than English, the new language policy specified for bridging for Grade 3 is to continue using the local language(s) that children fluently can speak and used already for schooling purpose to become a resource and enhance teaching and learning in English. Therefore, this study will assess the role of two local languages that were used

in the Elementary Schools and also used for the bridging process in Grade 3 class. The local languages are namely *Pidgin* and *Wahgi*. *Pidgin* is the national language of Papua New Guinea and *Wahgi* language is spoken in the South *Wahgi* electorate of Western Highlands Province.

## Section Two: Literature Review

### 2.1 Introduction

Speaking more than one language has been important for many people living in bi/multilingual societies throughout the world. Such knowledge helped them to break language barriers to communicate, trade, and resolve problems that were life determining (Wardhaugh, 1998). Most of such societies accepted

schooling system for their children and this meant that teachers worked in classrooms that had children that were bilinguals or multilinguals (Clarkson, 2004). But the impact of such language background on learning mathematics, hence on the teaching of mathematics, has only recently been recognized. This literature review highlights wider discussions on the impacts of learning and teaching within bi/multilingual classroom environment.

## **2.2 Learning and Teaching Mathematics in bi/multilingual Classroom**

Learning in a bi/multilingual environment was the focus of many studies and a point of discussion over a long period of time. Therefore, a general debate on the effects of bi/multilingualism on the learners goes back decades. We will not rehearse the arguments here as they have been described elsewhere (Saunders, 1988). Some authors maintain that bi/multilingual must have a negative effect on language development, educational attainment, cognitive growth and intelligence (Reynold, 1928; Saer, 1963 both in cited in Setati & Adler, 2001). While others argue that under certain conditions bilingual skills can have positive effects on the learning process (Baker,1993; Cummins,1981, 1984; Cummins & Merrill,1986)

In the case of mathematics, the relationship between bi/multilingual and mathematics learning has long been recognized. Dawe (1983), Clarkson (1991), Zepp (1989) and Stevens et al (1993) have all argued that

bi/multilingualism does not necessary impede mathematics learning. These studies have drawn extensively on Cummins (1981) theory of the relationship between language and cognition. Cummins distinguished different levels and kinds of bilingualism, and showed a relationship between learning, levels of proficiency in both languages, and the additive/subtractive model of bilingual education used in a school (Clarkson,1991; Setati & Adler, 2001). It supports that when students are fluent speakers of both L1 (first language) and L2 (second language), it benefits cognitive process that results in successful learning.

Most commonly, it is perceived that cognition process that results in successful learning is a personal event that takes place in the heads of each learner and the process is not affected by any external factors (Von Glaserffeld,1995). If learning is perceived only as a personal cognition development, it would deny the important role of teaching and hence the language used by the teacher in the communication process that enhance learning (Vygotsky,1986). According to Mercer (1995), teachers and their teaching play a greater role in initiating and guiding knowledge construction. They use language as the predominant medium to achieve this task.

However, many studies have had students and their learning as their central foci in a bi/multilingual situation, but very few have focused on the teacher's

role and their use of languages in mathematics teaching. This was acknowledged by Clarkson (2004) while scanning about 300 articles at least written in English for four journals dedicated to research in mathematics education from 2000 to 2003 (*Journal for Research in Mathematics Education, Educational Studies in Mathematics, For the Learning of Mathematics* and *Mathematics Education Research Journal*). However, a few studies that focused on the role of the teacher and the language they used for teaching, were those that focused on code-switching in a bi/multilingual classroom environment. It is described below.

#### **2.4 Code-Switching in Bi/Multilingual Mathematics Classroom**

As Setati & Adler (2001) say, code-switching in a school classroom usually refers to bilingual or multilingual settings, and at its most general, entails switching by the teachers and/or learners between language of instruction and the learners' main language. Code-switching as a teaching resource has been the focus of a good number of studies in mathematics education in the recent past in South Africa (Adler, 1996; Setati, 1998) and in the United States (Khisty, 1995; Moschkovich, 1999). These studies have either demonstrated and/or argued for the use of the learners' main language in teaching and learning mathematics as a support needed while the learners continue to develop proficiency in the language of instruction, at the same time as learning

mathematics (Setati & Adler, 2001). All of these studies have been framed by a conception of mediated learning, and of the communicative and cognitive functions of speech (Adler, 1996; Mercer, 1995). Learners need to talk to learn, and such talking to learn is a function of fluency and ease in the language of communication (Adler, 1996). Similarly, learners need to hear teachers speak in both the language they (students) speak fluently and language of instruction in classroom situations. In other words, talk was understood as a social thinking tool (Mercer, 1995). As Setati and Adler (2001) say, it is not surprising that problems arise when learner's main languages are not drawn on for talking by teachers. Studies carried out by Arthur (1994) in Botswana schools revealed that the absence of appropriate use of learner's main language in teaching, and a delivery of instruction through English only, subtracted out opportunities for exploratory talk, and thus for meaning-making. Teaching-learning communication was restricted to what she called final draft utterances in English, seemingly devoid of meaning. Arthur argued that this effect was a function of both the teacher and learners not having the opportunity to talk through a main language that student's speak fluently and hence for conceptual exploration through more informal language forms.

So far arguments for harnessing learner's main language(s) as a resource in teaching of mathematics in multilingual classrooms have been discussed. This

does not illuminate the specific challenges and teaching mathematics in bi-/multilingual classrooms where the LOLT is not the learner's main language is complicated. This is discussed below.

## 2.5 Challenges in Teaching and Learning

### Mathematics in Bi/Multilingual Classrooms

Mathematics teachers face different kinds of challenges in their bi-/multilingual classrooms from English Language teachers. The latter have as their goal, fluency and accuracy in the new language – English. Mathematics teachers, in contrast, have a dual task. They face the major demand of continuously needing to teach both mathematics and English at the same time (Adler, Slonimsky and Lelliot et.al. 1997, p.17).

We can also understand mathematical language, particularly as it is used in the school context, as comprising both informal and formal components. Informal language is the kind that learners use in everyday life to express their mathematical understandings. Formal mathematical language refers to the standard use of terminology (mathematics register), which is usually developed within formal settings like schools. As shown in *figure 2*, in most mathematics classrooms both forms of language are used and these can be either in written or spoken form. Pimm illuminates the challenges this poses for mathematics teachers:

One difficulty facing teachers, however, is how to encourage movement in their learners from the predominantly informal spoken language with which are all pretty fluent, to the formal language that is frequently perceived to be the landmark of mathematical activity (Pimm, 1991, p.21).

In bi-multilingual settings, the challenges become a three dimensional dynamic (Adler, 1996, 1998). It simultaneously entails access to the language of learning, access to mathematical discourse, and access to classroom discourse. There are ways of speaking English, of talking within and about mathematics, and of talking in school. The dynamic is given interesting illumination by Moschkovich (1999) in her study of discourse in a primary mathematics classroom in the USA where most learners were Spanish speakers. Through her analysis of classroom transcripts, Moschkovich (1999) is able to show the significant effects of practices like 'revoicing' by the teacher. Here, in the whole class setting, the teacher is able to listen to and work with learner's informal or incomplete mathematical language productions and revoice and so frame them towards appropriate or more formal mathematical discourse. In this way, the teacher enables access to English, mathematical English, and ways of talking mathematics in schools. The teacher understands her role as including the modeling of mathematical talk for the learners who are struggling simultaneously with concepts and their appropriate naming in English, the language of teaching.

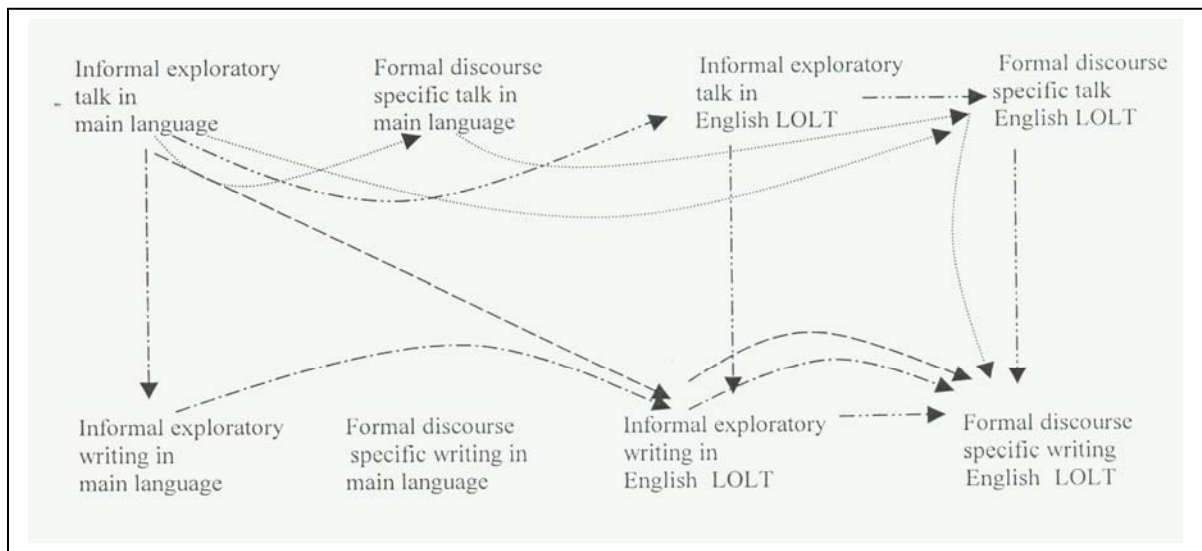


Figure 2. Routes of Mathematics Discourse (Setati & Adler, 2001)

## **Section Three: Methodology**

### **3.1 Introduction**

This section outlines the methodology of this study. It describes the participating schools and their teachers, and data collection techniques.

### **3.2 Participating Schools and Teachers**

Teachers were selected within two language boundaries. They were *Wahgi*, which the locals refer to as *Yu Woi* and Pidgin. *Yu Woi* is spoken in Mid-*Wahgi* area of Western Highlands Province. Since Pidgin is widely spoken in the town areas, the study location chosen was town Primary Schools in Goroka of Eastern Highlands Province. This study particularly targeted the teachers of bridging class

(Grade 3) at the lower Primary sector within these two language boundaries. The participating teachers and schools will be described within these language boundaries.

#### **3.2.1 South Wahgi Primary Schools**

There are seven Primary Schools in South Wahgi electorate of Western Highlands Province. This study has at least covered five of these schools. They are; (1) Tsigmil Primary Schools; (2) Raphael Kome Primary Schools; (3) John Bosco Primary School; (4) Minj Tee Primary School and (5) Mondmil Primary School

From these schools, the mathematics lessons of four teachers from three schools were observed and they

were Tsigmil Primary School (1 teacher), Raphael Kome Primary School (2 teachers) and John Bosco Primary School (1 teacher). The researcher did not observe lessons from Minj Tee and Mondmil Primary schools, but only interviewed their headmasters and teachers. Even though, these schools were called Primary Schools, they did not run bridging program because they did not have feeder Elementary Schools that could come as Grade 3, the first Graders of their Primary Schools. It was called Primary School because they had Grade 7 and 8, which they describe it as top-down Primary Schools. Since this study targeted the role of the local language in a bridging program, the researcher did not observe the lessons of Grade 3 teachers in these schools.

**4.2.2 Goroka Town Primary Schools**

Teachers from three town Primary Schools in Goroka were involved in this study. They are; (1) West Goroka Primary School; (2) North Goroka Primary School and (3) Kama Primary School. The mathematics lessons of eight teachers were observed from these schools. Five (5) teachers were observed from West Primary Schools, two (2) from North

Goroka Primary School and one (1) from Kama Primary School.

**3.4 Data Collection Technique**

The major data collection technique used for this study was passive participant observation. This technique was aided by the use of audiotapes and video camera. The second method of collecting data was informal interviews.

**3.4.1 Passive Participant Observation**

The major tool for collecting data in this study was through lesson observation. This method has its roots in social and cultural anthropology, but it is freely used in other fields including Education (Crabtree and Miller, 1999). This method is normally used to give meaning to certain behaviors and beliefs by observing activities and interaction of a setting. The technique was suitable for this study, because it aimed to observe the use of the two local languages (Wahgi & Pidgin) in the talk of teachers as they taught mathematics and understand the meanings derived from the switch between these local languages and English.

**Table 1. Lesson Observation Specifications**

Language Location	Schools	Teachers	Audio Taped	Video Tapes
Wahgi Speaking Schools	Raphael Kome Primary School	A	*	*
		B	*	*
	Tsigmil Primary School	C	*	

	John Bosco Primary School	D	*	
Pidgin Speaking Schools	West Goroka Primary School	E	*	*
		F	*	*
		G	*	*
		H	*	*
		I	*	*
	Kama Primary School	J	*	
	North Goroka Primary School	K	*	
		L	*	
<b>Total Lessons</b>			<b>12 lessons</b>	<b>7 lessons</b>

using two types of technology and they were audio recorder and video recorder.

There were a total of 19 lessons observed. From these observations, 12 lessons were audio taped and 7 lessons were video taped. Lessons of teachers from all schools were audio taped. However, lessons of teachers from two schools, one from each language groups were video taped. Specifically, two lessons from Raphael Kome Primary School from Wahgi speaking area and five lessons from West Goroka Primary School for Pidgin Speaking schools were video taped.

### 3.4.2 Informal Interview

The researcher had number of conversation like interviews. This was to find out the general running of the bridging program and teacher's impression of the program.

Therefore, the researcher sat at the back of the classroom, observed and mostly listened to the talk of the teacher in his/her teaching. The researcher did not actively participate in the classroom situation. Therefore, the type of participant observation the researcher was engaged in was nonparticipant or passive participant observation (Spradley, 1980). As Spradley (1980) says, as a passive participant observer, the researchers position in the classroom was that of a bystander, spectator or loiterer. However, the researcher was actively observing the teaching and carefully listening to the language used in the teacher talk, aiming to identify the roles of the local language. This technique was largely aided by

## **Section Four:**

## **Result**

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### **4.1 Introduction**

The result is presented in two parts. The first part (4.2 – 4.3) briefly outlines the preliminary result of the research. Since the result is based on an ongoing study, the second part of this report describes the expected result of the overall project.

### **4.2 Bridging Program in Primary Schools**

The major aim of this study was to assess the bridging program that was implemented in the recent education reform under the new language policy. This study observed mixture of programs from the schools visited. Since this study focused on two groups of schools differentiated by their language uses, the bridging program will be described respectively.

#### ***4.2.1 Wahgi Primary Schools***

Out of the seven (7) Primary Schools in the South *Wahgi* Electorate, this study covered five schools. They were Tsigmil Primary School, Raphael Kome Primary School, John Bosco Primary School, Minj Tee Primary School and Mondmil Primary School.

The study found out that teachers from the first three Primary Schools (Tsigmil, Raphael Kome and John Bosco Primary School) have carried out bridging program, but teachers from the later two Primary Schools (Minj Tee and Mondmil Primary school) did not carry out the bridging program. The reasons given

by the headmasters of these schools were that they both did not have feeder Elementary Schools. Since there were no children coming from feeder elementary schools, where the local language suppose to be the main language of instruction, teachers at this school saw no need to carry out bridging program. The dominant language of instruction was English. According to the headmasters, these schools were called top-down Primary schools because they had Grade 7 & 8.

#### ***4.2.2 Goroka Town Primary Schools***

Among other Goroka town schools, three of them were visited. They were West Goroka Primary School, North Goroka Primary School and Kama Primary School. These schools used varying language practices, particularly for teachers at North Goroka Primary School. While teachers at the other schools were using both Pidgin and English in one mathematics lessons, teachers in North Goroka Primary School used only Pidgin on Tuesdays and Thursdays, and only English on Mondays, Wednesdays and Friday.

### **4.3 Languages used in the Bridging Program**

This section reports the number and types of language used within the bridging program. Since this study targeted two language boundaries, the discussion will be done respectively.

#### ***4.3.1 Schools within Wahgi Language Area***

Most language practices in *Wahgi* classrooms were multilingual. They used three languages and they were *Wahgi* (local language), Pidgin (national language) and English. However, in the teachers talk in the mathematics lessons that were observed, the

common dominant language was Pidgin (see Table 2). The second common dominant language was both *Wahgi* and English.

**Table 2. Dominant language in Wahgi Schools.**

Schools	Teachers	Dominant Language	Other Languages	
			Second Dominant	Less Dominant
Raphael Kome Primary School	A	Pidgin	<i>Wahgi</i>	English
	B	Pidgin	<i>Wahgi</i>	English
John Bosco Primary School	C	Pidgin	English	<i>Wahgi</i>
Tsigmil Primary School	D	Pidgin	English	<i>Wahgi</i>

#### 4.3.2 Schools in Goroka Town

As indicated earlier, teachers from two Goroka town Primary schools were engaged in bridging and their language practice was bilingual. They switched to use the local language (Pidgin) from English in mathematics teaching. However, the language that was used dominantly by the teachers was Pidgin (see table 3). This is regarded as the local language of the students.

**Table 3. Dominant languages in Goroka town Schools**

Schools	Teachers	Dominant Language	Other
West Goroka Primary Schools	A	Pidgin	English
	B	Pidgin	English
	C	Pidgin	English
	D	Pidgin	English
	E	Pidgin	English
Kama Primary Schools	F	Pidgin	English

#### 4.4 Overall expected Result of the Project

The result presented above is brief because it represents a project that is currently ongoing and the final result is yet to be put together as a PhD thesis. The above preliminary results are from the first interval of the study. Furthermore, the presented result is from the initial stages of data analyses.

These section outlines what types of result could be expected if the three interval of data is completed and detail data analysis is done. The whole project aims to answer two main questions.

1. What is the role of the local language in teaching mathematics?

2. What are the perspectives of teachers in using the local language to teach mathematics?

The following section describes the likely result under these questions.

#### ***4.4.1 What is the role of the local language in teaching mathematics?***

The major question this project aims to answer relates to identifying the role of the local language in teaching mathematics. Brief result presented here indicated that bridging program was taking place in most classrooms, where switching between the local language and English was taking place. It also showed that the local language was either actively or moderately used in teaching mathematics.

However, the study will go further and identify the common role the local language is being used for. In other words, the study will examine the common purpose it serves in the mathematics teaching. For example, it could be used to explain, or rephrase a mathematical statement, or define mathematical word, etc.

#### ***4.4.2 How is the local language being used to teach mathematics?***

The major language practice studied here is switching, but it is to and fro the local language. This study will examine what patterns are there in the switching practice of the teacher in mathematics lessons. *Figure 3* shows the possible path a teacher would take in the practice of switching languages. This study will identify the common path mathematics teachers took during their language practice of code-switching within the bridging program. In addition, during the switching and using the local language, the study will also examine how teachers shift between the informal and formal mathematics talk, particularly while using the local language. The study will identify the informal and formal

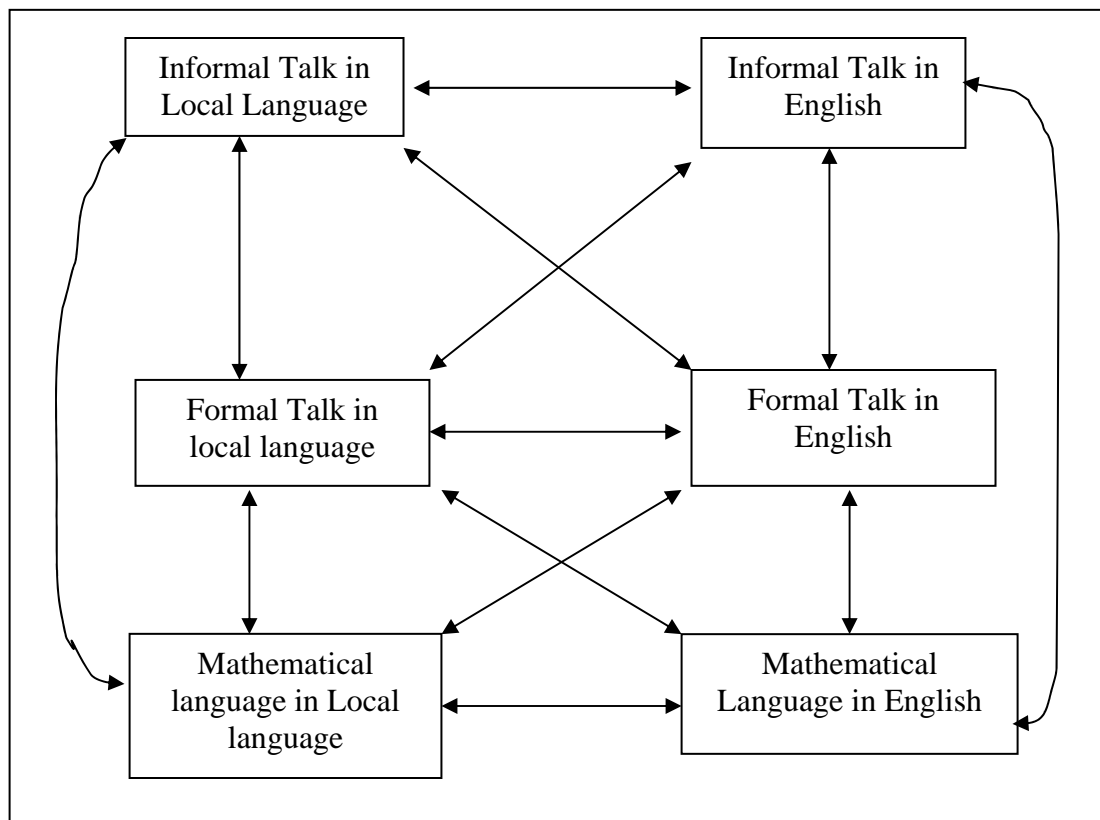


Figure 3. Pattern of Code-switching within informal and formal, between local language, English and mathematics language.

#### 4.4.3 What are the Teachers Perspectives of using Local language to teach Mathematics?

To switch or not to switch the local language is either deliberate or unconscious decision of the teachers. The local language is just another teaching resource like chart, chalk or duster. The effective use at the right time and context makes the resource useful. The person who makes such judgment is the teacher. Therefore, this study will target the teacher's perspectives about using

the local language in teaching mathematics. This will be discussed under the following questions.

### **Section Five:**

### **Summary**

The preliminary result outlined indicates a mixture of result. Some schools did carry out bridging program and few used other language practices.

Most schools in this study indicated that they were carrying out bridging program. Two schools in Goroka (out of three observed) and three schools in *Wahgi* speaking area (out of five visited) indicated that they carried out bridging program. The dominant language used during bridging was Pidgin for both *Wahgi* schools and Goroka town schools. Pidgin was the local language of the Goroka town schools. Even though, *Wahgi* was the local language, most teachers found in schools within this language boundary used Pidgin as a dominant language of instruction. The local language of *Wahgi* schools was not dominantly used to teach mathematics.

On the other hand, an equal number of schools did not carry out bridging programs. Those that did not carry out bridging program had two main reasons. Firstly, these schools were top-down Primary Schools. Therefore, they did not have feeder elementary schools. Children who came in as Grade 3 at these schools were not taught in the local language as main language of

instruction in their previous schooling. Consequently, there was no need for bridging program for their Grade 3 class in these schools. Secondly, some teachers in a school did not want to teach more than one language in a single lesson. They taught the local language in some days and English in others. Because it was a monolingual lesson, there was no need for bridging, meaning that the local language could not be used as a resource to teach while English was introduced formerly.

This study was part of an ongoing study. This report presented preliminary result. Therefore, general statement about bridging could not be firmly made from this study. However, the final report will be available when the researcher finalizes the study as his PhD thesis. Those who are interested can request for the abstract.

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