

Empowering local languages to create Filipino mathematical vocabulary

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“The Government shall take steps to initiate and sustain the use of Filipino as a medium of official communication and as language of instruction in the educational system.”

-1987 Philippine Constitution, Article IX, Sec. 6

“In addition to formal instruction, the use of English shall be encouraged as a language of interaction in school... In school publications, the use of English shall be given priority as far as practicable.”

*-Philippine Congressman Eduardo Gullas
Proposed House Bill No. 93*

Selecting an official medium of instruction in a bilingual country such as the Philippines is always a point of contention when crafting policies. On one hand, Filipino students have been taught in English with textbooks written in English to prepare students for a world where cultural borders are slowly deteriorating. On the other hand, the Philippines has 181 living languages (Paul, Simons, and Fennig, 2014) and most students would have one of these languages as their first language. In the latest major education policy decision, policy-makers crafted Philippine Republic Act No. 10533 of 2012 (RA 10533), where it has been suggested that teachers utilize students’ “mother tongue as a learning resource.” Issues of identity and equity arise from such decisions – do students speak in a way that is oppressed or privileged in the mathematics class? Although support for the use of native languages in mathematics education is prevalent in research (Limjap, 2011; Bernardo & Calleja, 2005; Bernardo, 2002), Philippine instruction and texts are still in English. I rationalize my research on critical grounds. In this paper, I argue for the incorporation of the students’ mother tongue to help make sense of mathematics. In order to provide a possible resolution to this debate, I also present the results of a study conducted to examine how Filipino speakers create their own mathematical vocabulary.

The case for Filipino mathematical vocabulary

The push for English as the language of instruction in the Philippines could be seen as early as 1901 during the aftermath of the American-Spanish war. In the report from (Library of Congress, 1901), the teaching of English was “received with great satisfaction by the natives” (p. 32). In the same report, Gen. Young foresees problems with creating textbooks to cater to every language and “native dialects must therefore be abandoned as a basis of instruction” (p. 48). Even with American civil rule absent from the islands, the effect of these laws remains to this day. Recent arguments in national politics have been argued for both sides but mostly the push for English.

English in the Philippines has been seen as a language within a world of “globalization, social mobility, and global competitiveness” (Tupas, 2011). Such ideas may have informed policies such as Executive Order 210 of 2003 (EO210) where English is to be used in all schools in the Philippines in order to prepare its students for new sectors in the economy. There were four proposed bills crafted by the 15th

Philippine congress (2010-2013) and three proposed bills from the current congress (16th) that called for English as the sole medium of instruction and only one bill that incorporated one's native language. Table 1 presents the rationale behind attempts at legislating the medium of instruction. Bills that proposed English as the medium of instruction rationalized this move on economical and globalization grounds. More recently, RA10533 encourages that the "first and dominant language of the learners shall serve as the fundamental language of education" and will shift to a bilingual education as the student matures in the system.

Table 1. Some Philippine legislation on language of instruction

Congress and Proposed Bill	Rationale
15 th , HB00093; 16 th , HB00311	"Targeting the learning of two languages is difficult for the Filipino learners..."
15 th , HB00162*	"Using the language the child understands not only affirms the value of the child and his cultural heritage but also enables the child to immediately master the lessons..."
15 th , HB00191; 16 th , HB00366	"Without English language proficiency... it is difficult for a Filipino graduate to get jobs anywhere in this country and anywhere in this world."
15 th , HB01245	"Filipino workers are generally preferred over other nationalities for overseas work because of their ability to converse and understand English."

* This is the sole proposal that incorporates the inclusion of the child's language.

If the government and stakeholders of education want to encourage native languages in the classroom, teachers and administrators must make a decision on the way mathematics is communicated. Phakeng & Moschovich (2013) warns against this dichotomy of the native language versus English and suggests that a flexible combination of languages should be used to support mathematical learning. Roberts (1998) posits a scenario where Western mathematical concepts are integrated with native languages and preserve native grammatical structure. This serves as alternative where the language would have to accommodate to the mathematics. Unfortunately, the proposed laws push for English as not only the medium of instruction but also for interaction and school publications. If these laws are implemented, schools are metaphorically and literally speaking languages that students do not fully understand. It is the small proportion of Filipino English speakers who will benefit from such a system and the majority of Filipinos who live in environments where English is a foreign language will continue to be silenced (Bernardo, 2004).

Creation of Filipino mathematical vocabulary

I conducted a study to look at how four Filipino speakers co-constructed vocabulary for common mathematical terms to offer an empirical side to how teachers, administrators, and curriculum creators can begin to offer a "dictionary" of terms to help students access mathematics in their language.

Participants, data and analysis

Four fluent Filipino speakers were asked to engage in creating Filipino mathematical vocabulary (FMV). By fluent, I considered speakers who could converse, read, and comprehend any Filipino vocabulary. The participants were raised in the Philippines, went to school (K-10/11) in the Philippines, and are fluent in Tagalog. No participant was a mathematician or mathematics teacher; in diSessa's (1996) academic terminology, "just plain folk." The participants were interviewed as a group to let intersubjectivity (Wertsch, 1986) play out.

The participants were presented with a mathematical word and were asked to give a Filipino word or create a word (e.g., compounding) that is the best analog for the mathematical word. Once the participants settle on a term, they were presented with a researcher-created word, which they could critique to abandon, modify, or keep their initial word. The words used were: variable, term, equation, polynomial, and graph. To analyze the interview, I mapped out the evolution of words from the initial prompt and what ways were used to create a new word. The ways in which words were created underwent rounds of coding (Strauss & Corbin, 1990). Since there is no stable FMV, I did not force the group to come up with just one word as their final translation to emphasize that this process of creating FMV is in transition.

Results

Prologue: Nora's "practical" mathematics

On the first prompt, one of the participants, Nora, expressed hesitation of creating vocabulary. When prompted to create a word for variable, she explains:

Nora Cheap shot 'to but whatever... Oo, cheap shot. [It's a cheap shot but whatever...Yeah, cheap shot] You know why? Can I say it now? ... 'Coz it's easier to learn it in English if you know that you're-... I know it's a cheap shot. It's a cheap way but it's- it's useful and I'm all about being practical.

Interviewer What do you mean by practical?

Nora Practical like it doesn't take a lot of brain power to say variable [and] *varyabol*.

Nora evaluates using the word *varyabol* for variable as "practical" and bearing a low cognitive load. In adding on to her evaluation, she views copying as a means of translating and also allows for easy memory retrieval:

Nora But I think that the fact that you're trying to say in a Filipino way helps a lot in trying- in recognition and remembering what a word means...If it sounds familiar or either you use the same sounds, you say it in a way a Filipino would, it would be easier to remember in.

This shows a privileging of English and words born out of an English structure not only are perceived to aid in learning but also retain a mathematical concept.

Techniques in FMV creation

Over the course of the interview, the participants employed several techniques to create FMV. A summary of the techniques is found in Table 2. To make sense of the data, two kinds of lexical items were identified. **Cores** are word(s) that are the result of a direct

translation of an attribute or root word from the mathematical word. **Stems** are words that are derived from cores or other stems.

Four main processes for creating FMV were found in the interview: distilling, rejecting, reinforcing, and refining. Within processes, there were a few techniques that were utilized by the participants. **Distilling** refers to the process of identifying attributes of a word or concept, which includes identifying root words. Cores are the result of distilling. There were two techniques for rejecting a core or stem. **Slimming** is identifying an attribute that a core possesses that hinders the mathematical concept. **Mathematizing** is identifying a salient attribute that the mathematical word has but the core does not. Once these techniques are employed the core is usually rejected. If a core is not rejected i.e., salient attributes line up words are **reinforced**. In some instances, reinforced words went through a round of refining. The three refining techniques do not change the core. **Cleaning** refers to affixing the word to align more attributes. **Re-categorizing** refers to changing a word's lexical category (part of speech) to accommodate more attributes. **Testing** is the technique of taking the word for a "test run" to determine if it sounds "right." This technique could trigger more refining or reinforcing.

Table 2. Techniques for Word Creation

	Technique	Structure	Example
	Distilling	X has attribute A .	<i>Equation</i> comes from equal. <i>Equation</i> also implies two sides.
Rejecting	Slimming	X could be a word for M . X means this, but X has attribute A . M does not have attribute A . X should be changed.	<i>Larawan</i> (picture) is not a good word for graph since you "capture" a picture, not create.
	Mathematizing	X is a good word for M . M has attribute A but X does not. X should be changed to accommodate attribute A .	A term can only contain one variable. <i>Pangkat</i> (group) implies more than one object. <i>Pangkat</i> has to be modified.
	Reinforcing	X could be a word for M . X means this, and X has attribute A . M also has attribute A . X should be considered.	<i>Tumbasan</i> implies the existence of two things such as an equation.

Refining	Cleaning	X is a good word for M . It would be better if we use P . PX is a better word for M .	$Pangkat$ (group) is a good word for polynomial. $Sang-$ (collectiveness) could help to indicate the idea that this is to be taken as one thing.
	Re-categorizing	X is a good word for M . X is a $C1$, M is a $C2$. X' is X as a CI .	Changing <i>guhit-relasyon</i> to <i>i-guhit</i> when used as a verb and <i>guhit-relasyon</i> for a noun.
	Testing		

An example: Searching for “equation”

As an illustration of the processes in creating FMV, below is a partial transcript for the creation of the word for *equation* along with techniques identified previously. Words in bold are identified as either cores or stems.

#	Speaker	Utterance	Technique
1	Basil	<i>May equals... sa Tagalog?</i> [There is equals... in Tagalog?]	Distilling: equals
2	Nora	Pantay.	Core identification
3	Sharon	Katumbas. Pantay.	Core identification
4	Interviewer	Pantay? Katumbas?	
5	Nora	Tumbasan. Haha.	Re-categorizing
6	Interviewer	Tumbasan?	
7	Basil	Oo, pwede. [Yeah, could be.]	
8	Interviewer	Bakit tumbasan? [Why tumbasan?]	
9	Nora	<i>Kasi equals.</i> [Because it's equals.]	Distilling: equals
10	Sharon	Equals.	
11	Interviewer	<i>Bakit hindi tumbas?</i> [Why not tumbas?]	
12	Nora	<i>Parang noun.</i> [It's like a noun.]	
13	Sharon	<i>Kasi tumbas</i> is just a noun. [Because <i>tumbas</i> is just a noun.] But then equation, you have to do something. It's...	Mathematizing: <i>Tumbas</i> does not have the attribute <i>do something</i> .
14	Basil	Tumbasan ng dalawang bahagi... [<i>Tumbasan</i> of two terms.]	Testing
15	Interviewer	No other- can you think of another one?	
16	Sharon	Pantay.	Core identification
17	Nora	Pantayan.	Re-categorizing
18	Interviewer	Bakit pantay? [Why pantay?] What does pantay mean?	
19	Sharon	Equal.	Distilling: equals
20	Interviewer	Equal.	
21	Sharon	Again, from the root word equal. Pantay. And then the... -an.	Distilling: equals
22	Basil	Mas naassociate ko yung pantay sa length. [I associate <i>pantay</i> more with length.]	

23	Interviewer	Ah, <i>pantay</i> is like a length?	
24	Basil	Parang hindi siya... [It's not like...]	Slimming: <i>Pantay</i> has the attribute length.
25	Interviewer	So do you think it might not work sometimes?	
26	Sharon	Katumbas.	
27	Basil	Tumbasan nga. [It's <i>tumbasan</i> .]	
28	Sharon	...you just make it equal.	
29	Nora	<i>Ang tumbasan kasi may parang</i> connote [sic]- <i>may</i> context <i>na may dalawang</i> things. [<i>Tumbasan</i> connotes- in context, there are two things.] [overtalk] <i>Oo, parang meron kang katapat. Ganun yung-</i>	Reinforcing: <i>Tumbas</i> has attribute <i>two things</i> .
30	Sharon	<i>Kulang yung tumbas.</i> [<i>Tumbas</i> isn't enough.]	
31	Nora	It's just a noun. <i>May dalawang part.</i> [There are two parts.]	
32	Sharon	<i>Pero pag tumbasan, may gagawin ka.</i> [But, if we use <i>tumbasan</i> , we have to do something.] It's an equation. You know the equation is like you have add, minus, or deal with...	Distilling: do something

In the scenario above, the main lines of cleaning of the core *tumbas* had to do with the salient attributes of *two things* and *do something*. Nora and Basil both address the *two things* attribute in utterances 14 and 29. It seems that the group does not disagree with this attribute but there's no indication that consensus for the salience of this attribute exists. The second attribute that shaped the creation of the FMV was the attribute of *do something* that Sharon repeatedly suggests in utterances 13 and 32. Basil agrees in utterance 35 that the *do something* attribute seems to be salient. This attribute mimics the well-researched concept of the equal sign as a "do something signal" (Kieran, 1981, p. 319). Later in the interview, I attempt to induce the technique of mathematizing by presenting the equation $5 = 5$. Although the participants acknowledge the equation as a statement of truth, they maintain the word *tumbasan* for equation. These techniques are not done in a linguistic vacuum. As illustrated, the participants not only participated in linguistic activity but also engaged in mathematical concepts, and in creating FMV, understanding around mathematical concepts was uncovered in the process. More episodes and extended transcripts were excluded from this report to stay within word count.

Conclusion

Amidst policies that force teachers to use English as the medium of instruction and students to interact with mathematics in English, even if English is not their native tongue, issues of power emerge in the mathematics classroom through discourse. Filipinos should regain power in the mathematics classroom. In the study I conducted, there are several techniques that native Filipino speakers can do to utilize their language not only to become part of the mathematics classroom vernacular but also to reveal the way they think about mathematics. Teachers advocating the use of their students' native

tongues will be able to leverage these techniques not only to promote mathematical thinking but also to welcome their students back into the classroom.

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