
Scaffolding Early Indigenous Learners into the Language of Mathematics

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This paper derives from a large project that explores successful practices in the teaching of mathematics in remote and very remote Indigenous communities in Australia. The focus of this paper is from one case study where the community speaks a shared language – Kriol – across a large region while also trying to preserve its own languages. The school has adopted a number of strategic practices to help young learners gain access to mathematics through both the language and concepts of mathematics. As students progress through the school, scaffolds are removed and the induction into Standard Australian English is facilitated.

Language and Mathematics in Remote Australia

In the Australian context, unlike many other nations, the country is largely monolingual with the language of instruction being Standard Australian English (SAE). However, there are many other languages spoken by migrants as well as the First People. In the late 18th Century it was estimated that there were between 350 and 750 distinct Aboriginal languages and dialects across Australia. Many of the Indigenous languages have died so that by the start of the 21st century it is estimated that there are fewer than 150 languages remaining. Those that are surviving tend to be in remote areas most of which are common in the Northern Territory. These languages include Pitjantjartjara, Warlpiri, Tiwi and Yolngu groups of languages. In these remote communities, the Indigenous languages are used in the homes and across the communities so that the language of instruction is seen as a “foreign language” since it is only spoken in school and with government agencies. The home language pervades all other interactions outside these venues.

There are languages, such as Kriol spoken across the Kimberley region in Western Australia, which have evolved as language groups

have interacted with others and with English speakers. Across the Kimberley, Kriol is the language spoken by most Aboriginal people and with SAE being the language of instruction at schools and in contexts outside communities. It is a recognized language with its own form and rules. Inflection has been identified as being a key part of many of the Kriol languages (Meakins, 2011)

A further language spoken by First People is that known as Aboriginal English (AE) which has many English words but also very nuanced by Aboriginal terms (Eades, 2013). AE may sound very similar to SAE but is a recognized language with its own special features (Malcolm, 2013). As languages develop, there is a cross influences so that AE evolves but increasingly there are AE words that are being taken up in SAE. An example of this is the term “deadly” which is used an adjective. It is best described to convey meaning of something of great value. It conveys greater, and a more emotive, meaning than English equivalents so is being adopted into SAE. In Australian research where there has been a focus on Indigenous learners and language has recognized the importance of teachers paying attention to scaffolding learners between their home language and the language of instruction (Oliver, Rochecouste, Vanderford, & Grote, 2011) as well as resources developed to support learners and learning (Disbray & Loakes, 2013). Other countries also recognize that importance of recognizing the importance of bi-lingual approaches to working with Indigenous students whose languages are different from that of the instructional discourse (Wiltse, 2011).

The early years are important for both language development and in shaping the dispositions of learners towards mathematics. It is also important for the development of fundamental mathematical concepts particularly for students whose home language is not that of the school language (Lee, Lee, & Amaro-Jiménez, 2011). There is a movement towards having instruction in the early years in the home language (Chitera, 2011) and with a progressive scaffolding to the language (usually English) as the students progress through school.

While there are quite strong disparities between diverse groups, it is also acknowledged that even for English language speakers, coming to learn mathematics in English for students who live in poverty whose home language is English, there are quite profound challenges (Brown, Cady, & Lubinski, 2011). In their work, Brown et al, found that poverty is inextricably bound to academic language development

and discourse diversities. Developing practices that support the mathematical and language development becomes critical for success for students living in poverty and for those whose language is different from the dominant discourse of classroom instruction.

One of the main challenges for shifting towards a process where mathematics teachers also focus on the language demands of mathematics instruction is with the preparedness of teachers to undertake this task (Tan, 2011). In classrooms where there are language disparities between the home language and that of the language of instruction (such as English) teachers need to be aware of the nuances in the two languages in order to specifically target and address language demands for English Language Learners (ELLs). Teachers need to be aware of the language demands of mathematics if they are able to successfully transition speakers whose home language is different from school mathematics instruction into successful learning of mathematics (Chitera, 2012).

The Remote Numeracy Project

The larger project from which this paper is generated seeks to develop 32 case studies from across Australia that demonstrated success in numeracy/mathematics. The cases are in remote and very remote areas across Queensland, Northern Territory, Western Australia, South Australia, and New South Wales. The schools are selected on the basis of their success in numeracy/mathematics, that they have high percentages of Aboriginal/Torres Strait Islander people (Indigenous Australians), and are in remote or very remote areas of the country. Success in numeracy is defined through either performance on national testing since this is the only way of comparing schools across Australia. Personal recommendations from district personnel are also considered since it is recognized that there are limits to the national testing scheme. Schools are able to provide their own evidence of success which extends beyond the limited testing protocols of the national testing scheme. The field work consists of interviews with staff and lesson observations as well as collection of school documents. The cases are largely ethnographic in form and are not evaluative. It is expected that the stories will be quite different for a wide range of reasons given the very diverse contexts within which the schools are

located. Each school is written up as an individual case study and the stories are shared through a project website. The data presented in this paper is drawn from one school where there was a very strong emphasis on language.

Bardulu: A Case Study

Bardulu School (a pseudonym to protect the identity of the school in accordance with University Ethics) is a small school in the Kimberley region of Western Australia. The students speak a local language—Kriol—which is a creole that has developed across the Kimberley region. Kriol is spoken at home and across the communities while the school emphasizes the use of Standard Australian English (SAE) in the classroom. The school has adopted a both-ways approach to teaching where there is a strong focus on language, and in particular recognizing and valuing the home language of the students, and then building transitions to assist students from their home language into SAE. The approach is underpinned by a strong valuing of Kriol alongside recognition that coming to learn SAE is empowering for students and a key function of formal schooling. Such an approach is often referred to as a “two-ways” or “both ways” approach in many Australian schools working with remote Aboriginal (and Torres Strait Islander) communities (Frawley & Fasoli, 2012). The approach seeks to value both cultures (and languages) while ensuring that students become empowered through being proficient in both cultures. Bardulu has adopted an approach where there is a strong immersion in the home language in the early years and resources have been made (usually by the local people working at the school – AIEOs) that make explicit links between Kriol and Standard Australian English (SAE). As the students progress up the school, they are scaffolded into the use of SAE so that by the time they have completed their primary years of schooling, they should be competent in both SAE and Kriol. The school also teaches the home language as a dedicated language program. While Kriol is a commonly used language across the Kimberley, this has arisen through the death of many of the Indigenous languages of the region. There is a movement across the area to try to keep the home languages alive so many schools are implementing programs where elders who still speak the home

language of the communities are teaching language to the students. Bardulu also has an active language program operating at the school.

Exploring the Data

The transcribed data has been entered into NVivo and then coded using an evolving set of nodes. Once the data are coded, various analyses can be commenced, of which one is query in which relationships between and among concepts can be undertaken. NVivo also allowed for queries to be undertaken around particular constructs. For example, in one case, the school had a very strong emphasis on transitioning between the home language (Kriol) and the language of instruction (Standard Australian English – SAE). In the early years, there was an immersion process where students would be exposed to many texts in both Kriol and SAE. As they progressed through school, the scaffolds were progressively removed so that students could gain a proficiency in SAE. In querying how teachers and staff spoke of the use of Kriol (a Kimberley version of a creole), NVivo creates maps to enable pathways for understanding the use and relationships around constructs. Figure 1 shows how NVivo creates these relationships of constructs.

What is clear from this query is that there are many ways in which Kriol is used in the context of this one site. This can be seen from the visual representation of the NVivo query. Here it is possible to start to see how Kriol is used in the school, how it is scaffolded by the teachers and the Aboriginal Indigenous Education Officers (AIEO), and the issues around code switching. There are many aspects of Kriol being articulated by the participants. In scanning through the two sides of the inquiry, there is frequent use of terms and discussions around the linking of home language (Kriol) and school language (SAE).

The valuing of Kriol at Bardulu School is important in a both-ways program. Students' home language is valued and seen as a legitimate language. It helps build strong foundations of many mathematical concepts through the use of a language with which the students are familiar. In the early years, teachers work very closely with the Aboriginal staff. Collectively they are able to do considerably work in code switching and language development for the younger students. This is important given that rich spatial and prepositional language of school mathematics that is quite different in Kriol and home languages.

Language Practices

The approach taking in the classrooms was one where the teachers explicitly acknowledged that the students spoke a different language from that used for instruction. There was a very strong emphasis on the explicit teaching of SAE but also recognising and valuing home language. As many teachers remarked, it was important for the students to know that their home language was a valued language but different from that used in school:

Valuing home language is very important, because that's their knowledge that they bring to the classroom. We explicitly teach SAE. We teach kids that Kriol is a different language.

There was a strong use of Kriol in the early years of school so that the students are scaffolded into the use of SAE while also valuing the home language of the students.

We use lots of Kriol in junior years, but not much after Grade 3.

The way in which the both-ways approach was adopted was that teachers would have wrist bands—one red which represented Kriol and one black which represented English. Teachers would often direct attention to one band—for example, the black band, which then directed students' attention to speaking in that language. In this way, the lesson pacing was not disrupted but students were aware that they needed to use a particular code—either SAE or Kriol.

Teachers were also very positive in terms of the capacity of the students to learn mathematics. Recognising that there were challenges in terms of language and culture, teachers believed that these were not excuses for not providing a quality learning experience with high expectations of the students. The teacher's comment below was representative of the views of the teachers where they did not offer excuses for an impoverished curriculum, or for reducing the demands on language learning in mathematics.

Nothing can't be overcome. I don't dumb down my speaking; I prefer them to come to my level.

Similarly, another teacher offered the comment where she felt that it was an injustice if teachers did not provide good role models in the use of correct and deep language in mathematics.

I teach the proper words in maths e.g., numerator and denominator. I'm doing an injustice if I say well only one of you will know it, so I'm not going to teach it.

The comments offered by the teachers were also observed in their teaching practices. Most of the lessons observed at the school demonstrated that the teachers put into practice what they articulated in the interviews. Classrooms were language-rich with numerous displays on walls and with large banks of resources, often made by the staff, that met the needs of the students and built bridges between Kriol and SAE/Mathematics.

Creating Language-based Resources for Mathematics

Throughout the interviews there was a strong recognition of the inter-relationship between Kriol and SAE. The teachers were all able to articulate various areas of language use that impacted on the possibilities for learning and/or creating struggles in learning mathematics. Much like Pitjantjatjara, there are challenges in the use of prepositions and comparatives. A teacher noted this in her comments about the limits created through Kriol in terms of many mathematical concepts:

Difficulties with Kriol in maths – struggle with prepositions, and increase / decrease. This disadvantages them in terms of testing.

One of the strategies employed in the junior years of schooling was the strong linking between Kriol and SAE. Many of the AIEOs had a key role in creating rich resources for scaffolding learning mathematical language. One of the key resources was student-focussed books. The AIEO would take the students outside to model the language – for example, one book focused on spatial prepositions – above, under,

beside etc – and the students positioned themselves on play equipment to represent the words. Photographs were taken and the AIEO then wrote text in both Kriol and SAE to demonstrate the words. The key word was written in a different colour so could be identified easily. The children also enjoyed the books as they had photos of themselves in it. An example, taken from one of the books on positional language is shown below. The accompanying photo had a group of children inside the cubby house:

Olu pre primary insiedwai la kubbi house.

The Pre-Primaries are inside the cubby house

On another page a group of students were standing underneath the bridge in the climbing frame.

Orlu pre primary standingup bud ununeet.

The Pre primaries are standing under the bridge.

Similarly, the AIEOs also made resources that had relevance to the students' home lives. For example, they had created a song "Five pies in the Bardulu shop" which was a version of "Mother Duck" where, in the pie song, a pie is eaten and the students are learning to count backwards from five. Other resources were made where mathematical songs were translated into Kriol and the students sang the Kriol and English versions.

There had been considerable support for the AIEOs to develop their skills in order to construct the books. The AIEOs use cameras, word processing, laminating and binding. The books are often of the "big book" genre so that they are read aloud as a group activity.

AIEOs from the valley used to get together and type the books (Kriol / English). AIEO takes the kids out, takes the photos of the kids.

The schools across the region were all part of the government school sector. The regional office supported the professional learning of the AIEOs. The AIEOs were taken to a central location and professional

development workshops were made available to build their skills and knowledge in order to construct stories to support the students.

In constructing the resources for the students, teachers also recognised the importance of the students being part of the resources. This helped to engage the learners. As the resources have been made over a number of years, young students enjoy seeing family and siblings in the books in their classroom. The books are both in the large “big book” format as well as smaller books that the students have as a reader.

The Importance of Local People: Aboriginal Indigenous Education Officers

The AIEOs are an integral part of the school and there is one AIEO in each classroom (except for one classroom). The role of the AIEO is to support the teacher with teaching but at this school their role is seen to be central to the operation of the school. This is summed up in the following comment from one of the administration team members. The school has proactively sought to ensure that their AIEOs are well trained and supported so that they are able to work alongside their teachers and that they also have key roles in the school.

AIEOs all have to have Cert 3 now. Three of our AIEOs are going for Cert 4. Also, we have two qualified language teachers, qualified to take class on their own. We also have one trainee language teacher. AIEOs run NAIDOC day—last year we went to the billabong and had a bbq and invited community. AIEOs have to give rewards on assembly. We expect them to model behaviour to kids. In a lot of Aboriginal schools, the kids get shame (shy) and won't stand up in front of people. We try to instil in them that there's no shame, it's about being brave and giving it a go. If our Aboriginal staff are doing it, there's no reason the kids can't do it.

As the AIEOs are members of the three communities that are served by the school, they are also very fluent in the home language (Kriol) and also live in the communities. Their cultural knowledge and

community knowledge are an integral part of the operations of the school programs.

One of the key roles within the school of the AIEOs that is a strength of the school is their role in language. The AIEOs have strong language skills that the students hear in their homes and communities so the AIEOs take on a role of translation and modeling code-switching to the students. Most of the teachers in remote schools do not remain in the communities for long periods of time, so very rarely speak the home languages of the students. The AIEOs have an integral role in building language skills in mathematics.

I am trying to get AIEOs to model code switching. Teacher speaks in SAE; AIEO models in home language. When I was a kid, my parents taught home language. I'm now learning home languages of this area, and the kids are impressed. I tease the kids, "It's not my language but I'm going to beat you in it!" My daughter is learning one of the home languages; I'm learning the other; we teach each other at home.

The teachers recognized that the AIEOs had very specific, and valuable, roles in the mathematics classroom. One of the teachers described the role that her AIEO played in the lower primary mathematics lessons. In this classroom, the AIEO was very important in the code switching between Kriol and SAE. She modelled the use of Kriol in mathematics lessons. Often the practice was one where the teacher would speak in SAE and then the AIEO would repeat the teacher's speech in Kriol. This enabled the students to hear the instructions or concepts in SAE but could also access meaning through Kriol. This was a very common practice in the lower primary where the students were encountering many mathematical concepts that were not commonplace in the family and/or community lives of the students.

Delta's [pseudonym in accordance with University Ethics] role in numeracy – she takes a small group, speaks Kriol, counts with the kids. She also does code switching mainly in lower grades. By the upper years, the kids should speak English.

The AIEOs also knew what was happening in the community, had significant cultural resources to assist with planning, and were a

valuable aide to the teachers. All the AIEOs had undertaken training and were well qualified to work alongside the teachers.

Conclusion

The value of language-based practices, and the valuable support offered by the AIEOs helps build a very strong community at the school in which language support is critical. At Bardulu, the AIEOs have a central role in the school in terms of supporting teachers in their planning of mathematics teaching and resources, as well as providing contextual information to explain behaviours and customs of the students. The school places a high status on the home languages of the students creating jumping boards from which the teachers build effective learning experiences in mathematics. The many concepts and terms of mathematics can create potential for misunderstandings but the practices adopted by the school are aimed at reducing this potential. As teachers are frequently “tourist teachers”—where they come into the school and stay a minimal period—here is a need to build sustainable practices within the school. To this end, the school has invested heavily in the training of the AIEOs and in so doing has built a culture whereby the AIEOs are a valued part of the teaching community within the school.

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