Great Expectations: Teaching Mathematics in English to Indigenous Language Speaking Students

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Effective mathematics teaching for Indigenous language speaking students, currently the lowest achieving group in Australia, needs to be based on fair expectations of both students and teachers. Teacher interviews in a small Northern Territory school, conducted within an ethnographic study, showed that teachers' decisions regarding level of mathematics curriculum taught were informed by students' prior learning and by the language dynamic in their classrooms. The need and pressure to teach Standard Australian English also affected how mathematics was taught.

The desire to improve mathematics and numeracy outcomes for Indigenous students is underpinned by ideas of equity and fairness. This paper considers whether some of the expectations placed on teachers in remote Indigenous schools are themselves fair and equitable, particularly the expectation that teachers teach mathematics at a curriculum level that would be deemed age-appropriate in a mainstream context. A consideration of teacher quality in remote schools needs also to include consideration of whether teachers are appropriately prepared for their role and whether what they are being asked to achieve is feasible. Unlike other Australian jurisdictions, a very high proportion of Indigenous students in remote Northern Territory schools are first language speakers of Indigenous Australian languages (Northern Territory Department of Education and Training [NTDET], 2011), but their teachers are frequently non-Indigenous English language speakers and most instruction is in English. An expectation that these students will learn and learn in an additional language (English) as well as achieve the same mathematical outcomes as students learning in their home language (English) does not appear to be equitable. High expectations of the learning capabilities of Indigenous language speaking students need to be clearly distinguished from unrealistic expectations of student prior learning and of what is achievable in a teaching environment where teachers and students do not share a common language. The decision to teach mathematics at a lower than so-called age-appropriate level may be an informed response to the learning needs of the students.

Literature review

The numeracy (and literacy) outcomes of remote Indigenous students in the Northern Territory are the lowest in Australia (Australian Curriculum Assessment and Reporting Authority [ACARA], 2011). Improving numeracy outcomes for these students is presented as a matter of urgency (Perso, 2013). Teacher quality is a significant factor in student learning (Hayes, Mills, Christie, & Lingard, 2006; Rowe, 2003). Many teachers in remote Indigenous schools are young and inexperienced (Heslop, 2003; Jorgensen, Grootenboer, Niesche, & Lerman, 2010). These young and inexperienced teachers therefore have a great deal of pressure on them to improve mathematics achievement of their students.

There are strong recommendations that teachers working in remote Indigenous schools should be trained in English as a Second Language (ESL) teaching methods (Standing Committee on Aboriginal and Torres Strait Islander Affairs, 2012; Wigglesworth,

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Simpson, & Loakes, 2011). Despite current Northern Territory policy to this effect, few teachers in remote Northern Territory schools have this training and teachers without such training continue to be employed (Commonwealth of Australia, 2005; Heslop, 2003; NTDET, 2012).

There is also a need for ESL teaching support specifically directed towards teaching mathematics. ESL courses generally focus on English language acquisition and literacy. The use of methods taught in these courses may contribute to teachers prioritising the teaching of literacy or English language over the teaching of mathematical concepts (McDonald, Warren, & DeVries, 2011). ESL methods or not, the practice of teaching both a language and mathematics in that language at the same time may result in teachers focussing more on the language than the mathematics, with students learning little mathematics (Barwell, Barton, & Setati, 2007). A recent resource address this is an annotation of the content descriptions of the Australian Curriculum Mathematics to support mathematics teaching in ESL contexts (ACARA, 2012).

Teachers are exhorted to have high expectations of the learning capabilities of their Indigenous students (Australian Education Ministers, 2008; Dockett, Mason, & Perry, 2006; Sarra, 2003). High expectations are sometimes equated with age related expectations. One of the principals that underpinned the Northern Territory's *Literacy and Numeracy Strategy* (2010–2012) was "a sincere belief that all children can learn the standard curriculum for their age cohort" (Perso, 2013, p. 31). Teacher expectations regarding higher order learning can improve with experience and pedagogical support (Jorgensen, Grootenboer, & Niesche, 2013).

Early years mathematics curricula also contain expectations of prior learning. Much of the prior learning which these curricula build upon is encountered and accessed through language. They focus on using everyday language for mathematical purposes (ACARA, 2013; NTDET, 2009). Indigenous students in remote Northern Territory schools often come to school without some of the prior mathematical learning assumed in the mathematics curriculum. Significantly, Australian Indigenous languages tend to not have many of the terms, structures and categories used in school mathematics (Harris, 1991; Thornton, Giles, Prescott, & Rhodes, 2011). These students also have prior learning that is often not valued sufficiently in the school. Some recent research projects have tried to build on this prior knowledge (Jorgensen et al., 2013; Sullivan & van Riel, 2013). There are those who feel the issue should be addressed at a preschool level, so that students do have the expected prior learning when they come to school (Masters, 2011; Perso, 2013). Students who are learning mathematics in a language which they are still learning need extra time (ACARA, 2013; NTDET, 2009). For these students, it is not just a matter of learning new mathematical vocabulary in English but also of learning new grammatical structures (Bradbury, 2012). The remainder of this paper looks at some teachers in a small remote Northern Territory school negotiated expectations about their use of the mathematics curriculum in a multilingual context.

Methodology

The results presented here are drawn from a larger ethnographic case study of language and mathematics education in a small remote community in the Northern Territory's Top End. The community has a population of around 300 Indigenous people, most of whom speak a number of Australian Indigenous languages. The school has four classes and around 70 students. Each class has a non-Indigenous teacher and a local Indigenous assistant teacher.

Over three years I spent approximately 35 weeks in the community as researcher and relief teacher.[1] I had been a fulltime teacher in the school in the preceding year. As participant–observer, I interacted with the teachers as a professional peer, concerned with the educational engagement and performance of the students. The sustained and repeated immersion necessary for rich ethnographic description (Geertz, 2000) was enabled by my casual employment in the school.

Five teachers participated in semi-structured interviews focussing on their perceptions and understandings of Indigenous mathematics practices, the use of language in mathematics programs, and best practice in mathematics lessons. One teacher was interviewed in the first year of the study and four teachers in the second year. The purpose was to elicit the teachers' attitudes and beliefs about teaching mathematics in a remote Indigenous school. The questions were general and designed to lead to further questions and probes in response to the teachers' answers. In analysis, I used elements of the constant comparison method (Glaser, 1965). Some of the data categories were predetermined by the interview questions while other emerged from the data as themes which the teachers raised.

In the second year of the study, I also formally observed some of the Early Years mathematics lessons. Some of these lessons were videoed by me, the teacher or the students. The interviews and observations took place within the greater ethnographic study. Thus the analysis was influenced by a body of informal observations of the teachers in practice, my personal knowledge of their class contexts, and conversations with the teachers over many visits about mathematics education and language in the school.

The teachers

Shirley was the Early Years teacher (Transition – Year 2) in the first year of the study.[2] She had close to 20 years of teaching experience at preschool and Early Years levels. Many years earlier she had taught in other remote schools, but had been teaching in a southern town while she raised her own children. Joanne and Simon, a couple, shared the lower Primary Years class (Years 2 – 4). They were both in their 30s, and each had several years teaching experience. They began teaching at the school in the middle of the first year of the study and taught there for a year, leaving halfway through the second year. Katie was the Early Years teacher (Transition – Year 2) in the second year of the study. In her mid-20s, she had a few years of teaching experience, and had been teaching in an upper socio-economic area of a state capital city. Leah taught the upper Primary Years class (Years 4 – 6) in the same year. Friends with Katie since university, she had also a few years of teaching experience from an upper socio-economic area of a state capital city. For all the teachers except Shirley, it was their first experience of teaching in a remote community and of working with Indigenous language speaking students.

The students

Sierra (aged 7 years, 2 months) and Zoe (aged 6 years, 11 months) were both students in Katie's class. Both Sierra and Zoe spoke one of the local languages at home and were learning English as an additional language. Their teacher regarded both of them as strong in mathematics; Zoe she described as having had "that light-bulb moment."

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[1] Dates have not been specified in the interests of protecting participants' identities.

[2] All names used are pseudonyms.

Findings and Discussion

Suitability of mathematics curriculum

All the teachers except Katie said that they did not find the Northern Territory Curriculum Framework [NTCF] suitable for their students. In particular, three of them said that their students were working at a lower level than the usual age level expectations. They had modified their programming and teaching accordingly.

> SHIRLEY: When I followed the curriculum for the Northern Territory, and I looked at it, I was quite sceptical, I just felt it was too advanced, the expectations of what I read and what I programmed for, when first did my program in the school, I think it was too advanced for these children. … I've actually taken the curriculum back. … I started at [Key Growth Point (KGP) 3] because that was the recommended level ... and that was really hard for the children, so I've taken it back. … I'm now finding we're catching up. But at first the children had no idea what I was trying to teach them.
>
> LEAH: I just find that I need to pitch it a lot lower than where they should be working at with the NTCF and a lot of it is language based which then means I need to teach them the language which means they're behind. I feel like I need to teach them so many things to keep up with the NTCF but there is not enough time.
>
> JOANNE: If we look at a lower level I think it's ok, so we've looking at, you know, KPG [whispers] Two.

Simon mentioned being unsure about the suitability of the content for his students.

Katie was the only teacher of the five who said that she found the mathematics curriculum suitable, "even bordering on easy in some regards." However, it turned out that Katie was using the *Diagnostic Net* (NTDET, 2010), which specifies minimum achievements expectations for children at each year level to progress through the curriculum, and she was not familiar with the NTCF at all. While the *Diagnostic Net was designed to support rather than replace the NTCF (Perso, 2010), in Katie's case, it was in fact replacing it.*

Joanne's whisper when she said that she was using Key Growth Point 2 of the mathematics curriculum was particularly telling. Although she and Simon had made a decision on what level of the mathematics curriculum to use based on their assessments of their students – valid pedagogical practice – she was reluctant to openly admit the level, because it was so much lower than the mainstream age-related expectations. For example, she had Year 2 students who could not yet count to ten, and who were still developing one-to-one correspondence in their counting practices.

Leah, who had the oldest class in the group, was even more conscious of the idea that her students should be achieving at a certain level, and of them being "behind". Her expression "there is not enough time" is by no means unusual as a comment on an overloaded curriculum, but in Leah's case it was made in relation to the dual need to teach her students the mathematics *and* the language required to learn the mathematics.

Language in mathematics teaching and learning

All of the teachers found language to be an important issue in teaching mathematics to their Indigenous students. Not sharing a language fluently made communication between teacher and students more difficult.

> SHIRLEY: Quite often when I'm teaching, and I look at their little faces and I think, 'Hey, hold on. Take a step back. Because what they're doing, they're not actually understanding what you're talking about.'

SIMON: You gotta have a shared understanding of the language which you use to teach in order to teach, to communicate the new mathematical language and the concepts. And out here obviously a lot of that shared understanding of the base language is not there which then makes the mathematical side, an extra, another leap forward, whereas in another school the maths language is really where most of the learning time is spent.

While the teachers found teaching their ESL students challenging, they were also aware of the difficulty for the students, trying to learn in a language they were still learning.

JOANNE: Language is the medium that we use to communicate our knowledge of maths to them and explain the process of maths … Yeah, and I think that's perhaps where we lose them when we do talk too much coz we do, yeah, when it's hard for them to listen to English.

LEAH: It's quite daunting for the kids. There's so many different words that you can use to describe all the same things and I think it's really unfair on the kids, it's quite overwhelming for the kids. I know that the mathematical knowledge, language is important, I understand it, but I just think that it's so full on that for a second language, it's really difficult for them.

KATIE: We have been working on positional language because we are doing *Rosie's Walk* [a common Early Years storybook]. And they grasp the concepts but they find the language difficult. … There's a lot to still work on with the language aspect.

In these comments, the teachers demonstrated awareness that the expectations on their students are already dauntingly high, particularly the expectation that the students will learn in what is basically a foreign language.

The teachers tended to focus on teaching skills or concepts rather than problem solving. While to some extent this might reflect their beliefs about mathematics or their students, it was also because often the students did not have the English language fluency to discuss mathematical ideas. Students' lack of proficiency in English also meant that reflective discussions at the end of a lesson were often curtailed.

Leah: I thought the most rich part of the lesson would then be coming back together and discussing it. And one person shared, no one listened and we couldn't continue so then we went outside.

The lack of shared language between teacher and students was cited by both Katie and Leah as one of the reasons the teachers at times did not know why mathematics lessons were successful or unsuccessful.

LEAH: I don't know if it was the kids that were there on the day, or if something had happened at home, or if it was too hard for them because it was too much language, or if they were tired, or what. I often find I don't know a lot of the time why things don't work.

KATIE: I never know if it's a teaching thing, or if it's a language thing, or if it's just a combination of everything.

Leah also saw the lack of shared language as an impediment to assessing her students' mathematical abilities.

Leah: I haven't been able to really see what they're capable of yet, because we're still working on the language and I find that a lot of the activities that we do to see how well they actually know it rely on the language.

With communication between teachers and students restricted by this lack of shared language, the teachers were not able to assess and teach as effectively as if there had been a shared language. This was a major factor influencing the teachers' decisions about which curriculum content and level to teach.

Teaching Standard Australian English in the Early Years

The school had an emphasis on teaching oral Standard Australian English [SAE], particularly in the Early Years. Katie focussed on teaching the use of prepositional phrases in simple SAE sentences. The following exchanges occurred between two students who were seated at the play dough table and Katie, who filmed the exchanges. Katie initiated the dialogues, saying, "Tell me what you're doing. One at a time. Sierra, in English, nice sentences." Sierra had been making a sausage with the play dough and then she began to make an egg.

KATIE: Where are you putting the egg?

SIERRA: Um, here.

KATIE: Can you say it in English?

SIERRA: I'm putting it in the sausage. I mean in the house in the sausage.

KATIE: You're making a house with the sausage.

SIERRA: And I'm putting this egg.

KATIE: Where are you putting it? You're putting it in –

SIERRA: – the – house

KATIE: Oh, good.

Although Sierra's "here" was in English, Katie's request "in English" seemed to mean complete sentences. Sierra then used the prepositional phrase "in the" three times but it was not validated by Katie, who re-prompted with stress on "in". The dashes represent pauses between words that were emphasised in a disjointed manner. Sierra then completed the sentence in this manner and Katie praised her.

Katie then talked with Zoe who had been listening to the above dialogue and who was also making egg-like shapes.

ZOE: I'm making, um, roun' ting, and I'm putting this ting where basket. And I'm gonna get another one.

KATIE: And you're gonna roll it.

ZOE: And I'm gonna roll it.

KATIE: And you're gonna put it ins...

ZOE: And I'm gonna put it in – the – basket.

KATIE: And you're going to put it inside the basket. Can you say that?

ZOE: I gonna put a inside wh… the basket

KATIE: How many are you putting in there?

ZOE: Um, five.

Zoe's "putting this ting where basket" shows the local dialectal use of where as a general locative preposition. Although where can mean 'on' or 'beside', in the case of a container such as a basket, the primary interpretation is 'in'. When prompted for a correction, Zoe used the staccato "in – the – basket", as had been modelled in the previous dialogue. Katie corrected her to use "inside", despite "in the basket" being an appropriate English phrase in the context. In both these dialogues, Katie's preoccupation with modelling the SAE phrases seemed to interfere with her listening to the students. Zoe did not receive affirmation from Katie for her expression of her intention to place the "round

thing" in the basket either in the local Indigenous English dialect or in a correct SAE sentence. These dialogues between Katie and her students show the tendency to focus on SAE grammar in favour of mathematical concept development (Barwell et al., 2007).

Conclusion

The teachers in this remote school experienced tensions between the goals to teach mathematics, teach SAE and teach at a so-called age-appropriate level. The students needed to learn the language in order to learn the mathematics. However, the teachers could become side-tracked by focussing on the language at the expense of the mathematics. These teachers did not begin teaching in the school with low expectations of their students' capabilities. The awareness that they were expected to be teaching their students at an age-appropriate level meant that they were reluctant to admit at what curriculum level they taught mathematics. However, they had all made the decision about what curriculum levels to use in response to their assessments of their students and their evaluations of their mathematics programs, demonstrating sound pedagogical practice. Undoubtedly, the teachers could be further supported to include improve the intellectual quality of their mathematics teaching (Jorgensen et al., 2013) and they could also be better trained in ESL teaching methods. Nevertheless, this study confirms that the education system and schools need to support teachers by recognising the "additional time and support" (ACARA, 2013, p. 9) needed by young Indigenous language speaking students being schooled in English. Recognition of the efforts of both teachers, who are impeded in their teaching by the lack of a shared language with their students, and of students, who are learning the medium of mathematical instruction as well as the content, should result in fairer, more equitable expectations of both teachers and students.

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