

Indigenous Language Speaking Students Learning Mathematics in English: Expectations of and for Teachers

Cris Edmonds-Wathen

Umeå University, Naturvetarhuset NMD, Umeå, Sweden

School of Education, Charles Darwin University, Casuarina, Northern Territory, Australia

Effective mathematics teaching for Indigenous language speaking students needs to be based on fair expectations of both students and teachers. Concepts of 'age-appropriate learning' and 'school readiness' structure assessment expectations that entire cohorts of Indigenous language speaking students are unable to meet. This institutionalises both student and teacher failure, as both are exhorted to meet unachievable expectations. The voices of teachers teaching in a very remote school provide insight into teachers' responses to the mismatch between the system expectations and the teaching context. Teacher interviews in a small Northern Territory school, conducted within an ethnographic study, showed that teachers' decisions regarding the 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. This leads to a reformulation of the concept of school readiness to ask how schools can be more ready for their Indigenous language speaking students in terms of preparing and supporting teachers.

■ **Keywords:** mathematics, language, remote education, expectations, teacher preparedness

A sense of urgency pervades the field of Indigenous education. The achievement gap between Indigenous and non-Indigenous students on the National Assessment Program: Literacy and Numeracy (NAPLAN) tests has been widely publicised (Forgasz & Leder, 2012). The numeracy (and literacy) outcomes of remote Indigenous students in the Northern Territory (NT) are the lowest in Australia (Australian Curriculum Assessment and Reporting Authority [ACARA], 2011). Improving numeracy outcomes for these students is therefore presented on many fronts as a matter of urgency.

Unlike other Australian jurisdictions, a very high proportion of Indigenous students in remote NT schools are first language speakers of Indigenous Australian languages (Northern Territory Department of Education and Training [NTDE], 2011). In most remote schools, the language of instruction is English and most teachers are non-Indigenous. This article reports on the experiences of a group of non-Indigenous teachers in a remote NT school and the challenges and tensions that they face teaching mathematics.

Teachers are frequently exhorted to have high expectations of the learning capabilities of their Indigenous stu-

dents (e.g., Dockett, Mason, & Perry, 2006; Sarra, 2003). However, behind the rhetoric on expectations there can be found a normative developmental discourse of mathematics learning. For example, one of the principles that underpinned the NT'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).

In Australia, Indigenous language speaking students participate in compulsory mathematics education generally designed and delivered by non-Indigenous English speakers. Since I take the position that mathematics is a cultural construct that evolves in and with language in response to people's needs (Barton, 2009; Bishop, 1988), I question the concept of age appropriateness in mathematics education: learning certain mathematical content at a certain age/year level is neither normal nor natural. This article discusses the teaching of mathematics to students in the early years of primary school, from the year

ADDRESS FOR CORRESPONDENCE: Cris Edmonds-Wathen, Umeå University, Naturvetarhuset NMD, Umeå SE-901 87 Sweden. Email: cris.edmonds-wathen@umu.se.

of school entry, termed Transition, to Year 4. Most of the children were aged between 5 and 10 years. They had not had very long learning English and learning in English. The teachers' related experiences demonstrate the flaws in the age-related curriculum expectations. Language is the main factor in this critique, both because it was the focus of the larger study from which the data is drawn and because it appeared so prominently in the teachers' interviews.

The expectation to both learn and learn in an additional language is not explicit in the learning expectations that teachers are exhorted to hold of their Indigenous language speaking students. Yet this is a considerable additional expectation that is not held of (English speaking) students who get to learn in their first language. When students come to school with prior learning different from that assumed in the curriculum, a teacher's decision to teach mathematics at a lower than so-called age-appropriate level may be an informed response to their students' learning needs. Such a decision places the teacher in a position of tension, their professional judgment at odds with the messages they receive from the curriculum, education authorities and the media.

This article reports the voices of the non-Indigenous teachers. To a large extent, I have allowed the voices of the teachers in the situation to speak for themselves. The voices of Indigenous people — the students, the assistant teachers and other community members — are absent. A complex array of events and forces that mirrored the lack of Indigenous voices in the decision-making processes of the school contributed to me not interviewing the Indigenous assistant teachers as originally planned. As in many such communities, outsiders make decisions about the form schooling will take. Teachers, also outsiders, are sent in with a burden of expectations to enact or impose this schooling. Although these teachers cannot say what community members need and want from school, they can say what they feel is and is not working in their classes.

The desire to improve mathematics and numeracy outcomes for Indigenous students is underpinned by ideas of equity. It is a misinterpretation of equity to aim for the same outcomes at the same ages despite different beginnings (Truscott & Malcolm, 2010). High expectations of the learning capabilities of Indigenous language speaking students need to be clearly differentiated 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. Indigenous education in the NT could be made fairer and more equitable for both students and teachers by taking account of specific expectations upon both of them that are inadequately acknowledged at policy and system level.

My goal in this article is to suggest feasible and practical improvements, comparatively small changes that could be made at a policy level, based on the experiences related by the teachers. Hence, I situate my critique within the Aus-

tralian political educational discourse, and the teachers speak from positions within this discourse. I have avoided explicit theoretical perspectives that might detract from a practical interpretation of the data. For example, applying Walkerdine's (1993) analysis of child development, while it might channel deserved attention towards a broader critique of the education system, might distract from the historical, social and political specificities of Indigenous education in the NT. And while Moschkovich's (2002) situated sociocultural perspective, focusing on the communicative resources of multilingual mathematics learners, could encourage recognition of the learning and communication capabilities of these students, it could also distract from understanding the impact of the significant communication difficulties between the teachers and the students on the teaching and learning processes. The themes described in the article therefore represent a synthesis of the ideas expressed by the teachers rather than ones created with reference to previous studies.

Literature Review

Teaching and Learning in English

The expectation that Indigenous language speaking children learn in a language in which they do not have sufficient competence is one of the most significant barriers to their successful learning (Lowell & Devlin, 1998; Silburn, Nutton, McKenzie, & Landrigan, 2011). Trying to learn the language of instruction while at the same time learning a subject such as mathematics is much harder for children than learning that subject in a language in which they are fluent (Cummins, 1979; Pinnock & Vijayakumar, 2009). These students need extra time to learn subject specific content (ACARA, 2013; Northern Territory Department of Education and Training [NTDET], 2009). They need to learn new grammatical structures as well as mathematical vocabulary in English (Wilkinson & Bradbury, 2013). More generally, 'many children who are expected to learn mathematics in classrooms where their native tongues are not spoken *simply do not comprehend what their teachers and textbooks are trying to communicate to them*' (Ellerton & Clements, 1991, p. 33, emphasis added). The language demands of learning mathematics mean that to some extent the mathematics learning has to follow the language learning.

Many Indigenous language speaking students in Australia do not have access to mathematics education in their first languages, as in many other parts of the world (see e.g., Barwell, 2014). There are many Indigenous languages in Australia for which there are no speakers who are qualified teachers. Over the past 20 years there has been a decrease in the number of Indigenous language speaking teachers trained (Simpson, Caffery, & McConvell, 2009). Many Indigenous languages have neither teaching resources nor a developed mathematics register, that is, a way to talk about school mathematics (Meaney, Fairhall, & Trinick,

2008). There has also been erosion in systemic support for bilingual schooling in the NT (Nicholls, 2005) and a pervasive belief dominating language policy in education that monolingualism is the norm, which sees Australian Indigenous languages and English as in competition in schools (McConvell, 2008).

Government policy has also been directed against learning in first languages. At the time of the study, the NT had in place the 'Compulsory Teaching in English for the First Four Hours of Each School Day' policy (Northern Territory Government, 2009). This policy mandated that all teaching in NT schools in the first 4 hours of each day be in English, effectively banning bilingual education. It was explicitly directed towards Indigenous students, with the stated aim of improving literacy and numeracy outcomes.

While literacy and numeracy are skill sets that can be and are achieved in many languages, there is a powerful perception in Australia that numeracy and literacy need to be achieved in English (Wilson, 2014). The measurement of literacy and numeracy in English only helps perpetuate the perception that these are skill sets that are linked to English.

There are strong recommendations that teachers 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, Simpson, & Loakes, 2011). More accurately, many Indigenous language speaking students are considered English as an Additional Language of Dialect (EAL/D) learners. ESL is used because it is the term generally used in schools and the curriculum at the time of the research. Despite the NT policy to this effect, few teachers in remote NT schools have this training and teachers without such training continue to be employed (NTDE, 2012a). In fact, use of these methods has declined in the NT and there is little professional support for teachers in this area (Wilson, 2014).

There is a lack of ESL teaching support specifically directed towards teaching mathematics. ESL courses generally focus on English language acquisition and literacy (e.g., NTDE, 2011). 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). Whether using ESL methods or not, the practice of teaching both a language and mathematics in that language at the same time may result in teachers focusing more on the language than the mathematics, with students learning little mathematics (Barwell, Barton, & Setati, 2007).

Assessment and Age-Level Expectations

NAPLAN tests are set by school year level, which generally depends on age. Year level also determines a compulsory A–E grade according to achievement against curriculum standards. D and E grades are 'below expectations'.

The urgency for Indigenous language speaking students to achieve against these expectations was clearly articulated in the NT's *Diagnostic Net*, a curriculum support document for numeracy and literacy that specified minimum achievements by year level required for students to make satisfactory academic progress (NTDET, 2010). Teachers were required to make a 'yes' or 'no' judgment about whether students were meeting the expectations. Support material stated that it was urgent that children who did not meet the expectations should 'catch up' and 'keep up' (Perso, 2010, p. 8). However, other support material also noted that students learning in English as an Additional Language or Dialect in the early phases of learning 'are *more than likely* to be monitored as not meeting expectations' (NTDE, 2012b, p. 13, emphasis added). Entire classes of students in remote Indigenous language speaking communities were therefore categorised as needing to 'catch up'. Many Indigenous students who have made substantial progress from previous years are likely to receive 'noes', 'fails' or 'below expectation' reports all the way through their schooling (Masters, 2011). Students, teachers and families are unable to see student progress in such reports.

The justification for these assessments is that the expectations are age appropriate (Perso, 2013). Flint and Peim (2012) identify age-stratified curricula as containing a 'developmental imperative' (p. 85), where the curriculum is perceived as dovetailing with normal development. Perceived normal development manifests in the expectations of prior learning contained in Early Years mathematics curricula (Edmonds-Wathen, 2013a). Much of the prior learning which these curricula build upon is encountered and accessed through language. Curriculum indicators or descriptors talk about using *everyday language* for mathematical purposes (ACARA, 2013; NTDET, 2009). Indigenous students in remote NT 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 some of the terms, structures and categories used in school mathematics (Harris, 1991; Wilkinson & Bradbury, 2013). These students also have prior learning that is not valued or understood in the school. For example, in this community, students may have a sophisticated understanding of the two main senses of 'in front' and 'behind' (the first sense intrinsic to the orientation and location of a reference object and the second sense relative to the orientation and location of the viewer); however, their uses of the two senses may vary contextually from the uses accepted by the English speaking teacher, and this variation may be interpreted by the teacher as a lack of conceptual knowledge (Edmonds-Wathen, 2014).

Masters (2011) suggests improving the chances of Indigenous students meeting expectations and benchmarks by improving 'school-readiness', and in particular to teaching English in the pre-school years 'at the

earliest possible ages' (p. 40). This early teaching of English is also supported by Wilson (2014), who states: 'The education system has opportunities to directly shape educational outcomes almost as soon as children are born' (p. 19). This overlooks the fact that Indigenous children are often engaged in valuable learning of language, culture and society with their own families in these pre-school years. While participation in good quality pre-school education will increase 'school-readiness', this should not be at the expense of Indigenous children's right to develop their own language, culture and worldview. Care needs to be taken that pre-school education is not assimilationist and does not impede conceptual development in the home language. While Wilson cites research that describes the cognitive benefits of learning multiple languages, he does not take account of the unequal statuses of English and Australian Indigenous languages. The fragile ecology of Australian Indigenous languages and the Australian monolingual mindset is such that early teaching of English can directly contribute to the demise of Australian Indigenous languages (Evans, 2010).

The expectation that remote Indigenous language speaking students should achieve 'age-appropriate' outcomes while being taught in English seems to be at odds with the extra time that students learning in an additional language require, with a curriculum that makes assumptions of prior learning that is less likely for these students to have than some other cohorts, and with the fact that most of their teachers are not trained in appropriate methodologies for the linguistic context of the classroom.

Teacher Quality

Teacher quality is often mentioned as a particularly significant factor in student learning (e.g., Rowe, 2003). Many teachers in remote Indigenous schools are young and inexperienced (Jorgensen, Grootenboer, Niesche, & Lerman, 2010). Their comparative lack of experience means that in many cases their potential to become proficient or highly accomplished teachers has not yet been realised. Low student achievement in these schools is therefore attributed in part to the teacher's lack of proficiency. However, as Gutiérrez (2013) points out, what is involved in being a highly accomplished teacher cannot be separated from the students one teaches and contexts in which one teaches. When teachers and students do not share a language and teachers have not been trained in ESL methodologies, this clearly hampers their capacity to use effective verbal communication strategies.

The remainder of this article looks at how some teachers in a small remote NT school negotiated the multitude of expectations about their use of the mathematics curriculum in a multilingual context.

Context

The community, located in the Top End of the NT, has a population of around 300 Indigenous people, most

of whom speak one or more of a number of Australian Indigenous languages. In this region of Australia, multilingualism is a facet of local culture and traditions (Evans, 2010). English is spoken throughout the community in places such as the school, the clinic and the Shire office, but in all these places local languages are also widely spoken. Some families speak English at home, albeit an English that varies from the Standard Australian English taught in the school in terms of sound system, grammar and vocabulary.

The small school is part of a group school, made up of about a dozen very small schools of between one and seven teachers, and a central administration. The school has five teachers, including a Teaching Principal who has a part-time teaching load and four classes. It has around 70 students from Transition to Year 9, with each class covering several year levels. All the teachers are non-Indigenous. During the period of research, only the Teaching Principal had been a NT resident before taking up a position at the school. This has always been an English medium school.

Each class also has a local Indigenous assistant teacher for all or part of the day. Some of the assistant teachers have formal certificate qualifications. The assistant teacher has many roles in the school, including cultural liaison and providing educational assistance to individuals and small groups of students. One of the important roles of the assistant teacher is 'to make comprehensible to the students the non-Aboriginal teacher's discourse' (Moses & Wigglesworth, 2008, p. 130).

The student population varies. Most students attend the school with only brief and exceptional absences from the community. Some students visit from other communities in the region, and some students move between communities during the course of a year, such as moving between their mother's country and their father's country. Most of the students who attend the school have an ongoing connection to the community.

Changes in day-to-day attendance affect the teaching program in the school. There are individual students with almost 100% attendance and others who attend just 15% of the time. There is a seasonal pattern, with higher attendance in the first semester, when it is raining, than in the second, when it is more pleasant to be outside. Major ceremonies generally occur in the second half of the year. Funerals can occur at any time and can keep many children out of school for several weeks.

The school and community do not have an easy or close relationship. Other than minimal and necessary interactions, the school and community have little to do with each other. There is little shared use of resources. Parents sometimes accompany younger children in the Early Years class who are adjusting to school and reluctant to leave their families. From time to time the school organises an event to which families are invited, such as a sports carnival or Christmas concert. School presence is requested at an occasional community meeting. Local staff, such as assistant teachers, are unwilling to be spokespeople for

the school in the community or for the community in the school.

Methodology

The results presented here are drawn from a larger ethnographic case study of language and mathematics education in the community. The larger study also investigated some of the mathematical language and concepts which the children might be exposed to outside of school, and how these might be drawn on within the school (Edmonds-Wathen, 2013a; 2014). Over 3 years I spent approximately 35 weeks in the community both as researcher and relief teacher. I had been a full-time teacher in the school in the preceding year. My role as a white, tertiary-educated woman was as an insider to the school but as an outsider to the community who the school intended to serve. 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. Throughout the research period, my approach was critical rather than conventional (Thomas, 1993), aiming to propose alternatives that could improve the mathematics teaching in the school.

Five teachers participated in semi-structured interviews focusing 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, in order to inform proposed improvements to the mathematics program (Edmonds-Wathen, 2013a). 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 others emerged from the data as themes which the teachers raised. The interview analyses were influenced by a body of formal and 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 issue of expectations which is addressed in this article was one that emerged in analysis, rather than being in the original interview questions.

The Teachers

Shirley (all names used are pseudonyms) was the Early Years teacher (Transition–Year 2) in the first year of the study. She had close to 20 years of teaching experience at pre-school and Early Years levels. Many years earlier she had taught in other remote schools, but had more

recently 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. Leah taught the upper Primary Years class (Years 4–6) in the same year. Leah and Katie were friends in their mid-20s, with a few years of teaching experience in an upper socio-economic area of a state capital city. Except for Shirley, it was the teachers' first experience of teaching in a remote community and of working with Indigenous language speaking students.

Findings

Mathematics Programs

Mathematics was generally taught in the 90-minute block between recess and lunch, Monday to Thursday. While following the *Northern Territory Curriculum Framework* (NTCF; NTDET, 2009), individual teachers had a fair degree of autonomy in deciding the content and structure of their mathematics program. Number generally received more attention than other curriculum areas. Where possible, teachers used a mix of whole class and rotating small group work. Groups were usually dependent upon assistant teachers and other adults being present as it was difficult to get groups to work without adult facilitation. Rotations often included a session on the computers for this reason, since sometimes students would stay at a computer without adult assistance. Groups were generally arranged according to students' levels of mathematics achievement, but membership could also depend upon age/year level, attendance and group dynamic.

Suitability of Mathematics Curriculum

The entry levels of the NTCF are called the Key Growth Points, with Key Growth Point 1 an entry level for students with high support needs, and most students expected to be entering school at Key Growth Point 2 or 3. Beyond the Key Growth Points, mainstream students might be expected to be consolidating Band 1 level towards the end of Year 2.

All the teachers except Katie said that they did not find the 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 I 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, who was concerned about the amount of curriculum material she and her students were expected to cover, said that when she tried to teach lessons that were too advanced or too abstract, it was 'disastrous'.

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.

Shirley and Joanne said that the NTCF itself was suitable for their students once they pitched their teaching at a lower level.

Joanne: If we look at a lower level I think it's okay, so we're looking at, you know, KPG [whispers] 2.

Simon was the only teacher to comment on the suitability of the curriculum content itself. He said that he wasn't sure about the relevance due to his lack of familiarity with what his students would need in their lives. He also commented on the multiple curriculum and assessment documents that were in use in the Northern Territory.

Simon: It's hard to work out almost what is directed and what is, you know, a choice ... so what you have to do, and what you're encouraged to do, and what's offered to do that's right, and what you have to do at a system level and then within the regional level and the school level.

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, Katie was using the *Diagnostic Net* (NTDET, 2010) rather than the NTCF. The *Diagnostic Net* was designed to support rather than replace the NTCF (Perso, 2010), but in Katie's case it had replaced 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 — generally accepted as 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 10, and who were still developing one-to-one correspondence in their counting practices.

Leah, who had the oldest class, was even more conscious of expectations that her students should be achieving at a certain level, and of them being 'behind'. Her expression 'there is not enough time', not an unusual comment on an overloaded curriculum, was made specifically in relation

to the dual need to teach her students mathematics and the language required to learn the mathematics.

Language in Mathematics Teaching and Learning

Language was one of the most important issues in teaching mathematics for all the teachers. Largely, this was in terms of language as a communicative medium. Not sharing a language fluently made communication between teacher and students 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 Indigenous language speaking students challenging, they were also acutely 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.

As can be seen from these comments, the teachers were aware that the expectations on their students were already dauntingly high, particularly the expectation that the students would learn in a language they were still learning.

The teachers tended to focus on teaching skills or concepts rather than problem solving. This might reflect their beliefs about mathematics or their students, but it also appeared to be because often the students did not have the English language fluency to discuss mathematical ideas. 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.

It is also possible that the students did not share the teachers' understanding of the purposes of reflective discussion in mathematics learning, one of which is to develop conceptual understanding. The roles of questioning in Western school society and in Aboriginal society are quite different (Eades, 2013; Moses & Wigglesworth, 2008). Christie (2007) points out that Yolngu, another NT Indigenous people, appear not to appreciate the Western emphasis on abstraction, developed through talk, and that this may be a 'stumbling block' for Yolngu students learning mathematics.

The lack of shared language between teacher and students was cited by both Katie and Leah as one of the reasons that at times they 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.

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.

At various times some of the teachers banned the use of local Indigenous languages in class. The reason given was that students used local languages to tease each other and to swear, and also that students come to school to learn English. Students also exercise power in the classroom through the use of their home language, having private conversations to which the teacher does not have access. In this situation teachers can feel they need to control students' talk (Jorgensen, 2011). While the teachers did not defend their banning of local languages in class in terms of the 'Compulsory Teaching in English for the First Four Hours of Each School Day' policy (Northern Territory Government, 2009), it reflects the same attitude that school success should be measured in English.

Teacher Preparedness and Training

The teachers were expected to teach in this challenging environment with very little in the way of suitable or specific training. None of the teachers had received any training specifically focused on teaching mathematics to Indigenous students, but all thought more training specif-

ically for mathematics in an ESL situation would benefit them.

The teachers varied in how prepared they felt to teach mathematics in the remote Indigenous context. Both the teachers who were taking the Early Years class felt confident. Shirley credited her many years of experience in teaching Early Years, some in remote settings, and having done extensive workshops in mathematics for early childhood. Katie related her confidence to the level of mathematics that she was teaching, seeing it as 'just setting up those basic foundations generally'.

Both Joanne and Leah said they felt unprepared. Leah said her difficulties were selecting the appropriate level of teaching, and engaging the students in learning.

Leah: It'd be good if there was some [professional development training so that] outside school they could see the reason that they would need to learn maths. I feel like I'm fighting a bit of a losing battle out here with trying to teach maths, whereas I don't get that as much teaching them English. I think that because they know that they are going to need English if they are going into Darwin to be able to communicate to people to do things but they don't really seem to want to learn maths.

Joanne related her difficulties to the language situation. Simon was confident about the mathematics content, but said the language situation in the classroom presented challenges.

The teachers were concerned about the relevance of the mathematics they were teaching, and how to make it engaging. They saw making connections between mathematics and the students' lives as a way to make mathematics meaningful, but they seemed to have difficulty in doing so. Both Leah and Shirley felt that the students didn't see mathematics as relevant to their lives. Joanne said that she was not confident that she understood her students' world sufficiently to make these connections.

The teachers had all received some in-school training in the *Count Me in Too* (New South Wales Department of Education and Training, 2001) program, which was number focused. The training had focused on games and activities using the interactive whiteboard. Rather than a program or approach, the teachers saw *Count Me in Too* as a set of fun but expendable activities.

Katie: It was good as a base of activities that we could use but after a while they will run out.

During the course of their year in the school, Katie, Leah, Joanne and Simon all undertook a Teaching English to Speakers of Other Languages (TESOL) course at Charles Darwin University, attending intensives in the term breaks. Katie also attended an English as a Second Language for Indigenous Language Speaking Students (ESL for ILSS) conference. She found both of these experiences useful and by November was a lot more confident in her skills to teach in the ESL learning environment.

Katie: Having done the TESOL course has been really, really valuable. The first intensive was a bit dry and they did do stuff on grammar ... they couldn't really apply it to the languages here, because every Indigenous culture has its own similarities and differences with their languages which is quite difficult really, when you come to the challenge of teaching Indigenous kids ... but the next one was really good and having an ILSS program as well has probably really helped me look specifically at their language.

In summary, the teachers were underprepared, aware of it, and keen to receive more targeted training for their teaching context.

Conclusion

This study revealed a tension between the desire of the teachers to set high expectations of learning in their mathematics class and the desire to make learning accessible for the students. This tension included conflict between the goals of teaching mathematics, teaching Standard Australian English, and teaching at a so-called age-appropriate level. The teachers in this study negotiated these tensions in a professional manner, choosing to plan and teach lessons to engage their students. 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. The general acceptance of the content of the curriculum by the teachers, as well as the difficulties some of them had in making their mathematics teaching relevant, may be because they had not considered alternative mathematics curriculum possibilities.

The sometimes banning of home languages contributed to the devaluation of these languages by the school. Local languages were not seen as an important part of children's learning in the school. This inhibited students from access to languages in which they were cognitively and socially comfortable and confident. Often, it is only in the casual conversations with each other that Indigenous ESL students are able to use language in a normally complex and sophisticated way (Moses & Wigglesworth, 2008). Not only was the social function of home language use reduced for the students but the cognitive benefits of using home language to discuss their learning with each other was also denied to them.

A closely related issue is the training and practice of more Indigenous teachers, particularly Indigenous language speaking teachers. Highly skilled assistant teachers are considered not to be properly qualified to be a classroom teacher, because they lack a formal teaching degree. It is perhaps worth considering how the concept of *qualification* is constructed, if registered teachers are considered

qualified to teach in a language which their students do not understand and are unable to communicate with their students.

This study confirms that the education system and schools need to support teachers by recognising the additional time and support (ACARA, 2013) needed by young Indigenous language speaking students being schooled in English. Expectations on both teachers and students need to be motivatingly high without being unrealistic. The expectations that the teachers felt were placed upon them and their students contributed to a sense of underachievement on the part of the teachers. Unrealistic expectations created a situation where student learning was not officially recognised, where teacher efforts were not rewarded, and where teachers felt something akin to guilt for making gradually more informed decisions about their teaching programs and practices.

There are ways to assess individual progress that measure achievement instead of deficiency (Masters, 2011). Recognition of the efforts and achievements 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.

Indisputably, there remains a serious need to improve educational practices and outcomes for remote Indigenous language speaking students. However, the current sense of crisis does not support teachers and schools in this improvement. Serious improvement requires careful planning, appropriate training of teachers, and systemic recognition of the learning paths of students who are learning in an additional language.

It would be advantageous if outsider teachers were to stay in remote communities for longer periods, giving them more opportunity to learn about their students' cultures, histories and languages. However, extended teacher tenure in remote schools will likely continue to be the exception, partly because these teachers are isolated from their own cultural context. Therefore, there needs to be a focus on how teachers can be better prepared for their specific contexts in a relatively short period of time, particularly for better training in ESL methodologies.

A reduction in the sense of urgency and a greater recognition of the efforts and achievements of teachers and their students could well contribute towards teachers choosing to stay longer in remote schools. The learning of Indigenous language speaking students in mathematics and other areas is also likely to improve if teaching is consciously and legitimately focused towards their actual working levels and is informed by sound ESL teaching methodologies. Teachers can only do this consistently and effectively if the school system supports them at policy and curriculum levels. Rather than directing the onus towards students to become more school ready in the preschool years, schools need to ready themselves for their students

by providing teachers with ESL training and ongoing professional support and by structuring expectations to reflect the real learning of students learning in an additional language as they learn that language.

Acknowledgments

This research was supported by an Australian Postgraduate Award scholarship. An earlier version of parts of this article was presented at the 36th Annual Conference of the Mathematics Education Research Group of Australasia, Melbourne (Edmonds-Wathen, 2013b).

References

- Australian Curriculum Assessment and Reporting Authority (2011). *National Assessment Program: Literacy and numeracy: Achievements in reading, persuasive writing, language conventions and numeracy national report for 2011*. Sydney, Australia: Author.
- Australian Curriculum Assessment and Reporting Authority (ACARA). (2013). *The Australian Curriculum Mathematics 4.1*. Retrieved from <http://www.australiancurriculum.edu.au>
- Barton, B. (2009). *The language of mathematics: Telling mathematical tales*. New York: Springer.
- Barwell, R. (2014). Centripetal and centrifugal language forces in one elementary school second language mathematics classroom. *ZDM*, 46, 911–922.
- Barwell, R., Barton, B., & Setati, M. (2007). Multilingual issues in mathematics education: Introduction. *Educational Studies in Mathematics*, 64, 113–119. doi:10.1007/s10649-006-9065-x
- Bishop, A.J. (1988). *Mathematical enculturation: A cultural perspective on mathematics education*. Dordrecht: Kluwer.
- Christie, M. (2007). *Maths as a cultural practice in a remote Aboriginal community* (Notes for a presentation at the SiMERR National Summit, Canberra, November 13, 2007). Retrieved from www.cdu.edu.au/centres/yaci/pdf/MACP_Michaels_reflections.pdf
- Cummins, J. (1979). Linguistic interdependence and the educational development of bilingual children. *Review of Educational Research*, 49, 222–251. doi:10.3102/00346543049002222
- Dockett, S., Mason, T., & Perry, B. (2006). Successful transition to school for Australian Aboriginal children. *Childhood Education*, 82, 139–144. doi:10.1080/00094056.2006.10521365
- Eades, D. (2013). *Aboriginal ways of using English*. Canberra, Australia: Aboriginal Studies Press.
- Edmonds-Wathen, C. (2013a). *Frame of reference in Iwaidja: Towards a culturally responsive early years mathematics program* (Doctoral dissertation). Retrieved from <https://researchbank.rmit.edu.au/view/rmit:160446>
- Edmonds-Wathen, C. (2013b). Great expectations: Teaching mathematics in English to Indigenous language speaking students. In *Mathematics education: Yesterday, today and tomorrow: Proceedings of the 36th Annual Conference of the Mathematics Education Research Group of Australasia* (pp. 266–273). Melbourne, Australia: MERGA.
- Edmonds-Wathen, C. (2014). Influences of Indigenous language on spatial frames of reference in Aboriginal English. *Mathematics Education Research Journal*, 26, 169–192. doi:10.1007/s13394-013-0085-4
- Ellerton, N.F., & Clements, M.A. (1991). *Mathematics in language: A review of language factors in mathematics learning*. Geelong, Australia: Deakin University.
- Evans, N. (2010). *Dying words: Endangered languages and what they have to tell us*. Chichester: Wiley-Blackwell.
- Flint, K.J., & Peim, N. (2012). *Rethinking the education improvement agenda: A critical philosophical approach*. London: Continuum.
- Forgasz, H.J., & Leder, G.C. (2012). Equity and quality of mathematics education: Research and media portrayals. In B. Atweh, M. Graven, W. Secada, & P. Valero (Eds.), *Mapping equity and quality in mathematics education* (pp. 205–222). The Netherlands: Springer.
- Geertz, C. (2000). *The interpretation of cultures* (2nd ed.). New York: Basic Books.
- Glaser, B.G. (1965). The constant comparative method of qualitative analysis. *Social Problems*, 12, 436–445. doi:<http://dx.doi.org/10.2307/798843>
- Gutiérrez, R. (2013). The sociopolitical turn in mathematics education. *Journal for Research in Mathematics Education*, 44, 37–68. doi:10.5951/jresmetheduc.44.1.0037
- Harris, P.J. (1991). *Mathematics in a cultural context: Aboriginal perspectives on space, time and money*. Geelong, Australia: Deakin University.
- Jorgensen, R. (2011). Language, culture and learning mathematics: A Bourdieuan analysis of Indigenous learning. In C. Wyatt-Smith, J. Elkins, & S. Gunn (Eds.), *Multiple perspectives on difficulties in learning literacy and numeracy* (pp. 315–329). Dordrecht, The Netherlands: Springer.
- Jorgensen (Zevenbergen), R., Grootenboer, P., Niesche, R., & Lerman, S. (2010). Challenges for teacher education: The mismatch between beliefs and practice in remote Indigenous contexts. *Asia-Pacific Journal of Teacher Education*, 38, 161–175. doi:10.1080/13598661003677580
- Lowell, A., & Devlin, B. (1998). Miscommunication between Aboriginal students and their non-Aboriginal teachers in a bilingual school. *Language, Culture and Curriculum*, 11, 367–389. doi:10.1080/07908319808666563
- Masters, G.N. (2011). *Improving educational outcomes in the Northern Territory: Preliminary advice to the Northern Territory Department of Education and Training, with a particular focus on the ongoing improvement of students' literacy and numeracy achievements*. Melbourne, Australia: ACER.
- McConnell, P. (2008). Language mixing and language shift in Indigenous Australia. In J. Simpson & G. Wigglesworth (Eds.), *Children's language and multilingualism: Indigenous language use at home and school* (pp. 237–260). London: Continuum.

- McDonald, S., Warren, E., & DeVries, E. (2011). Refocusing on oral language and rich representations to develop the early mathematical understandings of Indigenous students. *The Australian Journal of Indigenous Education*, 40, 9–17.
- Meaney, T., Fairhall, U., & Trinick, T. (2008). The role of language in ethnomathematics. *The Journal of Mathematics and Culture*, 3, 52–65.
- Moschkovich, J. (2002). A situated and sociocultural perspective on bilingual mathematics learners. *Mathematical thinking and learning*, 4, 189–212. doi:10.1207/S15327833MTL04023_5
- Moses, K., & Wigglesworth, G. (2008). The silence of the frogs: dysfunctional discourse in the 'English-only' Aboriginal classroom. In J. Simpson & G. Wigglesworth (Eds.), *Children's language and multilingualism: Indigenous language use at home and school* (pp. 129–153). London: Continuum.
- New South Wales Department of Education and Training. (2001). *Count me in too*. Sydney, Australia: Author.
- Nicholls, C. (2005). Death by a thousand cuts: Indigenous language bilingual education programmes in the Northern Territory of Australia, 1972–1998. *International Journal of Bilingual Education and Bilingualism*, 8, 160–177. doi:10.1080/13670050508668604
- Northern Territory Department of Education (NTDE). (2011). *Literacy framework for students with English as an Additional Language policy*. Darwin, Australia: Author. Retrieved from http://www.education.nt.gov.au/_data/assets/pdf_file/0007/20104/LiteracyFramework-EALLearnersPolicy.pdf
- Northern Territory Department of Education (NTDE). (2012a). *Framework for Learning English as an Additional Language policy*. Darwin, Australia: Author. Retrieved from <http://www.det.nt.gov.au/about-us/policies/documents/schools/framework-for-learning-english-as-an-additional-language>
- Northern Territory Department of Education (NTDE). (2012b). *Using the T-9 Net [PowerPoint]*. Darwin, Australia: Author. Retrieved from <http://www.det.nt.gov.au/teachers-educators/literacy-numeracy/literacy-and-numeracy-improvement>
- Northern Territory Department of Education and Training (NTDET). (2009). *Northern Territory Curriculum Framework*. Darwin, Australia: Author. Retrieved from <http://www.det.nt.gov.au/teachers-educators/curriculum-ntbos/ntcf>
- Northern Territory Department of Education and Training (NTDET). (2010). *Prioritising literacy and numeracy: Diagnostic net for Transition to Year 9*. Darwin, Australia: Author. Retrieved from <http://www.det.nt.gov.au/teachers-educators/literacy-numeracy/literacy-and-numeracy-strategy>
- Northern Territory Government. (2009). *Compulsory Teaching in English for the First Four Hours of Each School Day policy*. Darwin, Australia: Author. Retrieved from http://www.det.nt.gov.au/corporate/policies/curriculum_studies/CompulsoryEnglishFourHoursEachDay.pdf
- Perso, T. (2010). *Diagnostic Net for Transition to Year 9: Description of the Net and how to use it*. Darwin, Australia: NTDET.
- Perso, T. (2013). A systemic evidence-based strategy to improve Indigenous students' numeracy and literacy. In R. Jorgensen, P. Sullivan, & P. Grootenboer (Eds.), *Pedagogies to enhance learning for Indigenous students* (pp. 21–44). Singapore: Springer.
- Pinnock, H., & Vijayakumar, G. (2009). *Language and education: The missing link*. London: Save the Children and CfBT Education Trust.
- Rowe, K. (2003). The importance of teacher quality as a key determinant of students' experiences and outcomes of schooling. In M. Meiers (Ed.), *Building teacher quality: Research conference 2003 proceedings* (p. 3). Melbourne, Australia: ACER.
- Sarra, C. (2003). *Young and black and deadly: Strategies for improving outcomes for Indigenous students*. Canberra, Australia: Australian College of Educators.
- Silburn, S.R., Nutton, G., McKenzie, J.W., & Landrigan, M. (2011). *Early years English language acquisition and instructional approaches for Aboriginal students with home languages other than English: A systematic review*. Darwin, Australia: Menzies School of Health Research.
- Simpson, J., Caffery, J., & McConvell, P. (2009). *Gaps in Australia's Indigenous Language policy: Dismantling bilingual education in the Northern Territory*. Canberra, Australia: Australian Institute of Aboriginal and Torres Strait Islander Studies.
- Standing Committee on Aboriginal and Torres Strait Islander Affairs. (2012). *Our land, our languages: Language learning in Indigenous communities*. Canberra, Australia: Commonwealth of Australia.
- Thomas, J. (1993). *Doing critical ethnography*. Newbury Park, CA: Sage Publications.
- Truscott, A., & Malcolm, I. (2010). Closing the policy–practice gap: Making Indigenous language policy more than empty rhetoric. In J. Hobson, K. Lowe, S. Poetsch, & M. Walsh (Eds.), *Re-awakening languages: Theory and practice in the revitalisation of Australia's Indigenous languages* (pp. 6–21). Sydney, Australia: Sydney University Press.
- Walkerdine, V. (1993). Beyond developmentalism? *Theory & Psychology*, 3, 451–469.
- Wigglesworth, G., Simpson, J., & Loakes, D. (2011). NAPLAN language assessments for Indigenous children in remote communities: Issues and problems. *Australian Review of Applied Linguistics*, 34, 320–343.
- Wilkinson, M., & Bradbury, J. (2013). Number and two languages in the early years: Report on a project with paraprofessional Indigenous teachers in two NT northeast Arnhem Yolngu schools. *Australian Review of Applied Linguistics*, 36, 335–354.

Wilson, B. (2014). *A share in the future: Review of Indigenous education in the Northern Territory*. Darwin: Department of Education. Retrieved from

http://www.education.nt.gov.au/__data/assets/pdf_file/0007/37294/A-Share-in-the-Future-The-Review-of-Indigenous-Education-in-the-Northern-Territory.pdf

About the Author

Cris Edmonds-Wathen is engaged in postdoctoral studies regarding grammatical structures used in mathematics in different languages. She is also part of a project to improve the teaching of cultural mathematics in Papua New Guinea. Her PhD focused on spatial frames of reference in Iwaidja, a language of northwest Arnhem Land.