

INDIGENOUS AND NON-INDIGENOUS TEACHING RELATIONSHIPS IN THREE MATHEMATICS CLASSROOMS IN REMOTE QUEENSLAND¹

Tom J Cooper
Queensland University
of Technology

Annette R Baturu
Queensland University
of Technology

Elizabeth Warren
Australian Catholic
University

In Queensland, Indigenous mathematics performance lags at least two years behind that of non-Indigenous students (Queensland Studies Authority, 2004). This low performance is exacerbated in remote communities where teachers are generally inexperienced, non-Indigenous, usually stay in the school for two years only, and do not know how to work effectively with their Indigenous aides. This paper reports on part of a 3-year study to enhance students' outcomes through improving relationships between teachers, Indigenous teacher-aides, students and community members. It describes three case studies and identifies training, equality in partnerships, communication, and the "westernised" nature of classrooms as issues for effective teacher/aide relationships.

Indigenous students continue to be the most educationally disadvantaged group in Australia with respect to mathematics. With their consistently lower levels of academic performance and higher rates of absenteeism (Bourke, Rigby & Burden 2000; Queensland Studies Authority, 2004), they are poorly prepared to share the benefits of modern society. Adult employment levels are very low necessitating a reliance on welfare.

There is now an expectation that schools must make a difference to Indigenous students' mathematics achievement and should seek strategies to enhance their mathematics learning (Cataldi & Partington, 1998). However, rural and remote schools with Indigenous populations find it difficult to attract experienced teachers. As a consequence, their teachers are nearly always non-Indigenous, young and inexperienced and commonly leave after two years. While ultimately Australia needs more trained Indigenous teachers, an intermediate goal must be the more effective classroom use of Indigenous teacher-aides (who are mostly older, more experienced in dealing with Indigenous students, and have strong commitment and connections to the local community). These aides should be seen as the key to teaching success in a school with indigenous students (Baturu & Cooper, 2004; Clark, 2000).

Indigenous aides in remote community schools are under-utilised in the mathematics teaching/learning process, being more administrative assistants and "crowd controllers" than partners in classroom teaching (Baturu & Cooper, 2004; Baturu, Cooper & Warren, 2004). In many instances, they are not trained in their role,

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provided with sufficient information to assist the teachers, and included in curriculum decisions. However, Baturu and Cooper (2004) found that a small amount of training impacted positively on Indigenous teacher aides' motivation, their ability to assist teachers in mathematics classrooms and students' mathematics learning outcomes.

Furthermore, Indigenous aides have the potential to bridge the gap between culture and western schooling, particularly in contextualising (Matthews, 2003) mathematics learning so that mathematics concepts can have relevance and meaning for Indigenous students. Utilising cultural knowledge in mathematics classrooms is essential with Indigenous learners to offset the current view that Western schooling generally devalues Indigenous culture which it marginalises as primitive, simplistic and insignificant with respect to mathematics (Matthews, Howard & Perry, 2003; Sarra, 2003).

This paper reports on teacher/teacher-aide relationships in three classrooms within a 3-year project in remote North-West Queensland schools to enhance Indigenous mathematics learning through improving relationships between teachers, aides, students and community members.

METHOD

The project's methodology was mixed method. Quantitative data were collected on (a) students' mathematics performance (school- and system-based tests), attendance and attitudes to mathematics and mathematics learning, and (b) teachers' and aides' attitudes and beliefs towards mathematics and mathematics teaching and learning. These data were collected annually across three years. Qualitative data were collected through observations of classrooms, regular interviews with teachers and aides, and artefacts (e.g., examples of teaching units). Each year, the researchers provided professional development in two major mathematics strands from which two units of work were to be developed, taught and shared with other schools. These professional development sessions were undertaken on site with the aides.

The three cases. The three classroom teacher/teacher-aide interactions described in this paper are the result of observations and interviews in three schools representing a range of communities (labeled as *Rural 1*, *Rural 2* and *Regional* respectively). They were undertaken in the second year of the project while the teachers and teacher aides in the three classrooms were completing a unit of work that had to be developed: (1) to cater for Indigenous students; and (2) to form a partnership between the teachers and the teacher aides. All teachers were inexperienced; all teacher aides were long-term members of their communities. However, it should be noted that the schools paid the aides for student contact time only; preparation and reflection time with teachers were not considered part of their aide duties.

Rural 1, a small school of 39 students enrolled in P-7, was situated in a very small Indigenous community (approximately 300 people) where all students and most

residents were Indigenous. The community was isolated, being 150 km from the larger regional community. The focus classroom was the Year 4-7 class (14 students) taught by Anne (young, non-Indigenous, newly-graduated) with two Indigenous teacher aides, Betty and Barbara.

Rural 2 was also a small school (47 students enrolled in P-7) in a small country town (approximately 400 people) with a population comprising 50% Indigenous people. It was more isolated than Rural 1 being 300 km from the regional centre. However, the town had more commercial, business, and tourist facilities than Rural 1. The focus classroom was the Year 4-7 class of 16 students taught by Carl (mature, non-Indigenous, 3 years teaching experience) with two aides – Doris (Indigenous) and Deidre (non-Indigenous).

Regional was a larger school (300 students enrolled in P-7) with more than one draft of some Year levels; 60% of its students were Indigenous. The town of approximately 21000 people was the centre for all local, state, and national government agencies and had several large primary and secondary schools run by state, catholic, and independent education sectors. The focus classroom was the Year 1 class of 20 students taught by Eva (young, non-Indigenous, in her second year of teaching) with an Indigenous teacher aide, Fiona.

Procedure and analysis. Each of the classrooms was visited seven times in the year and the interactions between the teacher, aides and students observed (videotape and field notes). Two units of work were collected during the year. The teachers and aides were interviewed at each visit on their perceptions of their teaching and the effectiveness of their units (audiotape). As well, there were three professional development days at the central regional school to which all teachers traveled (the last of which is a conference in which teachers presented their units. There was a pre- and post interview each year at which teachers' and aides' beliefs re learning and teacher-aide partnerships were probed (audiotape).

The students' responses to the tests and surveys were analysed statistically for significant changes. The videotapes and audiotapes were transcribed and combined with attitude and belief survey responses, field notes, artefacts and units to form a profile of the classroom and the actions of the teachers and the teacher aides. This paper comes from analysis of the interviews and the observations.

THREE CASE STUDIES

Rural 1 (Year 4-7 class – 100% Indigenous community). The Indigenous community in which this school was situated held education in high regard. Student attendance at the school was very high (almost 100%), significantly higher than other communities. The reasons for this are uncertain but this excerpt from an interview with Anne (teacher) gives some insight:

Anne It is cool to go to school ... and the kids all know why someone is not here, they know if it is a good reason, or is it not so good reason. ... I think the parents push the kids to go to school. ... They [parents] get a bit

upset when their kids go away and don't do so well, and end up back here, and I know a few parents are very upset that there are kids back here, particularly elders.

Researcher: Why don't parents want their children to stay in (regional city) with relatives?

Anne Because of gambling and drinking, a lot of kids in ... they get into paint sniffing and so there ...

Researcher And these kids don't have it here? [No] No drugs?

Anne Nope, not with the young kids

In this classroom, mathematics was the teacher's least favourite subject and the students' favourite subject and, because of this, Anne taught it in the last teaching period of the day (traditionally a notoriously difficult time for teachers to foster and maintain student interest and learning). The students were well behaved, on task, and appeared to cope with what was predominantly a "westernised" style of classroom. Anne did not include her aides in her mathematics planning. Her lessons were normally structured in whole-class teaching followed by performance-homogenous group investigations and individual work on activities (e.g., computer activities). Her double-spaced classroom had ample room to accommodate individual desk work, group work, quiet reading, and computer work. The teacher aides moved amongst the desks assisting students in the whole-class lessons, worked with a group as they rotated through tasks or undertook an investigation, or helped with an activity as students moved through their work sequence. There was an excellent relationship between students, aides and teacher in the room. They were all very positive about the mathematics lessons and engaged in the classroom activities. The students readily helped each other; the aides encouraged students to stay on task and provided help when they could.

Betty and Barbara often seemed unaware of the particular activities to be taught each day and lacked the training to undertake some of the mathematics being covered. Because of this, they spent the start of each mathematics lesson sitting at their table beside the students and writing detailed notes on what the teacher was saying as she introduced the day's work. This was their way of trying to come to understand what the teacher wanted from the lesson. It was also their way of learning some mathematics. Anne's lack of attention to the aides' knowledge of mathematics and the mathematics that was to be covered in the lesson appeared to have three consequences. First, the aides' notes were often insufficient to enable them to provide appropriate mathematics assistance to the students. Thus, assistance was predominantly affective and behavioural – encouraging the students to keep trying, to stay on task and to not distract others – rather than cognitive (e.g., the mathematics focus of the activity) or even procedural (e.g., the sequence of steps to be followed). Second, the aides were sometimes slow to move to new activities. In one lesson, the students had to take measurements outside after completing some preliminary work in the classroom. These students outside worked unsupervised because the aides

appeared not to know that this was to happen. By the time they arrived, the data gathering had degenerated into one person measuring while all the rest watched. Third, the aides sometimes did not know the mathematics being taught. In the same lesson that had the outside measuring, one of the aides was unable to help students having difficulties with multiplying to calculate area. Interestingly, this problem was solved by one of the Year 7 students who came over and with a lovely manner showed both the students and the aide how to do the exercise.

Rural 2 (Year 4-7 class – 50% Indigenous community). The small country town in which the school was situated was 50% Indigenous and appeared to be divided into two communities – Indigenous and non-Indigenous. Like Rural 1, problems with alcohol, substance abuse and violence appeared to be less obvious than in other Indigenous communities (Fitzgerald, 2002).

The classroom in which Carl taught with Doris (Indigenous) and Deidre (non-Indigenous) was a single room. The students sat in three rows in front of a black board with the teacher's desk at the front. In the library next door and in an enclosed verandah beside the classroom, there was extra space in which there were computers and into which students moved for project work. Like Anne, Carl did all the planning and structured his mathematics lessons with a mixture of whole class work (where possible), ability groups and individual activity. The role of the aides appeared to be one of supporting the students with difficulties or giving one-on-one attention to low achievers. Attendance by the approximately 16 students appeared to be good and the students seemed engaged by the lessons. The Indigenous and non-Indigenous students' behaviour, demeanour and presentation was very similar; however, the performance of the Indigenous students was generally lower (they made up the majority of the students receiving special literacy and numeracy support).

To accommodate lack of out-of-school contact with his aides, Carl communicated his daily program to the aides through a notebook that had a section at the start for lessons and sections at the back for each student. Each night, Carl wrote in the front of the book what he intended to cover next day in the mathematics lesson. The aides read this part of the book when they arrived to see what would be covered. As the mathematics lessons occurred between the first and second recess period, the aides had time to ask questions of Carl in the first recess break. During the lessons, Doris and Deidre wrote into the back of the book (in each student's section) anything they noticed about any of the students they worked with, particularly any lack of understanding of topics, and any special efforts and achievements. Each night, Carl read through these notes and used the feedback to modify his teaching, preparing special group lessons for topics for which many students appeared to be having difficulties and finding individual work for students with unique problems.

Regional (Year 1 class – 60% Indigenous community). The Year 1 Indigenous students appeared to be of two types – (1) students whose families had been in the town for a long time and whose attendance, presentation and performance was

indistinguishable from non-Indigenous students, and (2) students of families who were new to the city, or who spent only part of the year in the city, and whose attendance was irregular and whose performance was low.

The room in which Eva taught with Fiona (her Indigenous teacher aide) was a double size classroom. Desks were placed in one area with other areas set aside for reading, working with materials, and group discussion. Although she undertook whole-class teaching at times, Eva's predominant *modus operandi* was to teach via rotating groups. She divided her class into high, middle and low ability groups. For each teaching episode, she developed three types of activities: (1) an initial activity that focused on introducing the idea through manipulating materials, teacher questioning and group discussion; (2) a follow-up activity that related material, language and symbol (if necessary) in a game situation; and (3) an activity that practised the ideas developed (a worksheet). The low achievers started at (1), the middle at (2), and the high at (3). Eva took the initial activities, Fiona supervised the game (after explicit instructions with regard to the mathematical focus of the task, the questions to elicit learning, and the specific mathematics language) whilst the worksheet activities were unsupervised. Eva planned these activities without her aide. Fiona had limited training in mathematics teaching and tutored most effectively in a structured environment such as the game activity where discussion and questions would be restricted by that environment. Therefore, unlike the aides observed in Rural 1 and 2, Fiona was treated as a teaching partner albeit in a limited way.

DISCUSSION AND CONCLUSIONS

The three cases highlighted the need to address the following issues: (1) training for both teachers and aides in mathematics knowledge, pedagogic knowledge, and forming effective partnerships; (2) more equitable partnerships that draw on both teacher knowledge and aide context/community knowledge for planning, delivery and reflection; (3) everyday communication; and (4) the continuing westernised nature of the classrooms.

Training. It was obvious from observations and unit plans that the teachers themselves needed training in mathematics structure and appropriate pedagogy and in how to work with effectively with Indigenous aides. Therefore, with the exception of Eva, the teachers found it difficult to provide an effective teaching framework for their aides. It was also obvious that the aides needed training in basic mathematical concepts, processes and pedagogy. The teachers were aware of their aides' mathematics deficiencies but none of them spent time, or even considered spending time, on training their aides. As strongly argued by Baturó, Warren and Cooper (2004) and RAND Mathematics Study Panel (2003), mathematics learning outcomes are very dependent on teachers' and aides' knowledge of mathematics.

The success of Eva's and Fiona's teaching (Regional) was based on using materials and pictures to build relationships between real world problems, language and symbols and providing Fiona with a role in games with which she could cope. Anne's

teacher aides, Betty and Barbara (Rural 1), did not have the mathematics to tutor their students effectively so they had little influence other than to encourage the students. Carl's aides, Doris and Deidre (Rural 2), could share ideas and keep records on misunderstandings but there was no instructional theory for them to follow in supporting the students. Thus, in cognitive terms, Fiona was the most effective in that her games fitted in the activity rotation that developed ideas from materials to symbols.

Equality in partnerships. All teachers were effective to some extent in integrating their aides in the teaching process with differing degrees of effectiveness in terms of student learning. Betty and Barbara (Rural 1) worked with groups or with students with difficulties but did not have the mathematics to do other than encourage and control behaviour; Doris and Deidre (Rural 2) followed the teacher's plan in the notebook but were very instrumental in their assistance; and Fiona (Regional) had a successful role in supervising the game activity but she could do little outside of this. So, although the teachers had found roles in the teaching-learning process for their aides, they had not formed partnerships with some equality between themselves and the aides. In particular, the aides were not involved in planning the programs and their ideas were not sought for other than local knowledge about the children. There was no realisation that the aides could make contributions in other ways (e.g., providing authentic and cultural contexts for learning) to mathematics teaching (see Matthews, Howard & Perry, 2003; Sarra, 2003). Only one classroom (Rural 2) had structured input (reporting on student errors) from the teacher aides – all others were one way, teacher to aide. It was evident that relationships would be more effective if the teachers and aides respect and value each others' culture.

Communication. Everyday communication was crucial for effective teaching and varied across the cases. For example, Anne, who disliked teaching mathematics, provided no prior communication to the aides about the particular mathematics that was to be covered and as such they were often left to "fend" for themselves in the classroom. Carl, on the other hand, communicated with his aides (albeit non face-to-face generally) about what mathematics concepts and processes were to be taught in a lesson and encouraged the aides to provide feedback (albeit written) to him about how the students were achieving. As such, he provided them with an integral function within the teaching and learning process. In Eva's case, restricting Fiona's role to one type of activity (games) enabled Eva to provide information quickly on the purpose, language and questioning required for successful learning from the game. However, there was little communication of how the game fitted into the overall context of the mathematical skills being taught. None of the teachers asked for any contribution from the aides into deciding what should be taught and how it should be taught.

Westernised nature of the classrooms. Finally, all classroom programs were strongly westernised – they could have been used with non-Indigenous students. There was no evidence of contextualising mathematics instruction (i.e., placing it within Indigenous culture) (Matthews, 2003; Matthews, Howard & Perry, 2003;

Sarra, 2003). Neither the Indigenous aides nor other community members were utilised in developing authentic learning contexts to help Indigenous students make sense of mathematics learning. Developing Indigenous contexts for mathematics became the focus of the teacher/aide relationships in the project's third year.

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