

# Teacher Aides and Their Pedagogical Contributions in the Underachieving Indigenous Mathematics Classroom

Gillian Kidman<sup>1</sup>, Tom Cooper<sup>2</sup>, Satwant Sandhu<sup>3</sup>  
YuMi Deadly Centre  
Queensland University of Technology, Brisbane  
g.kidman@qut.edu.au

**Abstract:** *This study examines the pedagogical contributions made by teacher aides in underperforming Indigenous mathematics secondary classrooms. Three teaching teams, each consisting of a teacher and their teacher aide, responded to semi-structured interviews. Their mathematics classrooms were observed for details of pedagogical contributions to the mathematics lessons. It was found that the pedagogical contributions of the teacher aides varied from co-teaching contributions, to the provision of menial support and behaviour management. The techniques used by the teacher aides to provide student feedback, to support behaviour management and to undertake questioning vary greatly, and this variance is also evident in the classroom atmosphere. Teacher aides are providing pedagogical contributions, and are engaged in instructional interactions, and are in a sense “teaching”.*

**Keywords:** Teacher aide, pedagogical contributions, Indigenous classrooms, mathematics, secondary school

## 1. Context and Introduction

This paper reports on a component of the AIM (Accelerated Indigenous Mathematics) Project which is funded by the Australian Commonwealth Government’s Closing the Gap: Expansion of Intensive Literacy and Numeracy program for Indigenous students. It assists secondary schools with Indigenous Year 8-10 students who are at a Year 2/3 level in mathematics. The project develops a Years 8-10 mathematics program that accelerates students’ learning to where they can access mathematical subjects in Years 11-12 and therefore enhance their employment and life chances. The AIM project is one of 10 large projects designed and implemented by the YuMi Deadly Centre. This is a Research Centre within the Faculty of Education at Queensland University of Technology in Australia which aims to improve the learning, employment and life chances of Australian Indigenous and low socioeconomic status students. In Australia, many of these students are academically behind. One strategy to assist the teacher in such classrooms is the use of a teacher aide. Teacher aides are classroom assistants who generally have strong commitment and connection to the local community, and are experienced in dealing with Indigenous students.

We adopt the definition that the teacher aide is one who provides direct and indirect support to the student, under the supervision of the teacher and the administration staff (Howard & Ford, 2007). It is interesting to note that in Howard and Ford’s definition, the teacher aide supports the student, indicating a direct link between the teacher aide and the student. Gerber, Finn, Achilles, and Boyd-Zacharias (2001) provided an analysis of how teacher aides have been utilised over time. The studies cited indicate that since the 1950’s, the main duties of teacher aides have been in relation to administration, menial tasks, and to the helping of individual students. Teacher aides are generally utilised for managing classroom behaviour and assisting teachers during group-work in the lower achieving classrooms (Baxter, Woodward & Olson, 2001). More recent studies cited by Gerber et. al. (2001) indicate that there is an increasing trend for the teacher aide to be involved in direct instruction of students in small groups, and in some cases, the entire class. Groom (2006) indicated that the role of the teacher aide was “to have a particular focus on supporting learning, including key aspects of the pupil’s personal and social development ... establishing a ‘positive relationship for

learning” (p.199). It seems the pedagogical contributions of the teacher aide have increased over time. There has been a shift from that of a classroom ‘helper’ to one that is more directed towards support of the teaching and learning process.

In reality, this may not be the case for Australian Indigenous classrooms. Warren, Cooper and Baturu (2004) described a large study in the Cape York Peninsula by Valadian and Randell which told of the Indigenous teacher aide’s role in the classroom to be that of a classroom helper with limited involvement with the students, despite the teacher aide often being in a very knowledgeable position in terms of the cultural and family backgrounds – variables of high significance in the Indigenous classroom. Indigenous teacher aides in Australian remote community schools are under-utilised in the mathematics classrooms. When they are present they are more likely to be administrative assistants and “crowd controllers” rather than partners in classroom teaching (Baturu & Cooper, 2004; Baturu, Cooper & Warren, 2004). In many instances, the Indigenous teacher aide is not trained in their role, they receive no information on how to assist their teacher in the classroom, and may not have a mathematical background beyond that of the students they are in the classroom to help.

Mathematics is not culture-free; culture is closely connected to the way in which we learn and understand mathematics (Ladson-Billings, 1997). Westernised styles of teaching mathematics by teachers, many of whom are oblivious to the culture and practices of Indigenous students, result in a gap in the teaching and learning process (Cooper, Baturu, & Warren, 2005). Linking cultural knowledge to the mathematics lesson is essential with Indigenous learners so that the mathematics becomes meaningful. According to Cooper, Baturu and Warren, the lack of experienced teachers in rural and remote schools with Indigenous students makes the role teacher aides play in classrooms vital to the educational success of the students. Teacher aides can be positively utilised to work collaboratively with teachers to bridge the cultural-content gap resulting in better teaching and learning (Warren et. al., 2004). Indigenous teacher 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. Only a small amount of training is necessary to give the Indigenous teacher aide the motivation to assist teachers in mathematics classrooms and students’ mathematics learning outcomes (Baturu & Cooper, 2004).

Warren, Cooper and Baturu (2004) found a paucity in the literature with regard to how the teacher and teacher aide work together to support Indigenous student. There is still paucity in such research, especially if the area of the pedagogical contributions being made by the teacher aide in the mathematics classroom is considered.

## **2. Focus of this study**

The current study was designed to obtain a detailed account of the pedagogical contributions of the teacher aide. While we recognise the context of the teacher aide pedagogical contribution may vary with lesson design and mathematical topic, we wanted to explore the contributions experienced by the student under everyday conditions. This study examined data from the Accelerating Indigenous Mathematics (AIM) Project to address questions relating to teacher aides in the secondary Years 8-10 mathematics classroom. There is little published information about teacher aides, their duties performed in Indigenous secondary mathematics classrooms and their pedagogical contributions. Our specific questions are:

- A) What are the classroom actions in Indigenous secondary mathematics classrooms?
- B) What are the pedagogical contributions of the teacher aide in these classrooms? and
- C) What classroom characteristics are highlighted by interrelationships between the pedagogical contributions?

## **3. Method**

### **3.1. Participants and settings**

This paper is part of a larger project investigating the acceleration of mathematics learning for underachieving Indigenous secondary school students. In the larger project there are 9 secondary schools, each with significant Indigenous populations of students studying mathematics in Years 8, 9 or 10. The vast majority of the students have a Year 2/3 mathematics level – hence they are underperforming. Three classrooms, representative of the larger project, are considered in this paper. Each classroom consists of a teaching team of a teacher and a teacher aide (neither of whom are trained to teach mathematics). The teacher aide is permanently assigned to the classroom teacher, and each teaching team has worked together for at least 1 year. The three classroom settings are as follows:

Classroom 1 is a Year 8 class in an Indigenous community school in Queensland, with students in their first year of secondary schooling. Teacher 1 is a young non-Indigenous man whose teacher training is in the performing arts. Teacher aide 1 has resided in Australia for approximately five years migrating to Australia from the African continent. He identifies with being Indigenous, but not Australian Indigenous.

Classroom 2 is a Year 9 class in a large regional city secondary school also in Queensland. Teacher 2 is a young non-Indigenous man whose teacher training is in physical education (sports). Teacher aide 2 is a middle aged Indigenous woman with little formal education, but who has a large amount of respect from the students.

Classroom 3 is a Year 10 class in an Indigenous community school in Queensland. Teacher 3 is a middle aged non-Indigenous woman who has lived in the community for several years. Teacher aide 3 is a middle aged Indigenous woman from a different tribe to the students.

### **3.2. Data sources**

Three sources of data were available concerning the teacher aides' classroom actions and pedagogical contributions:

General classroom observations had been made by a variety of researchers during scheduled school visits over an eight month period. These observations were recorded on a template document, and included comments about the teacher, teacher aide, mathematical topic and impressions of student learning. There were six of these subjective observations available for each classroom.

Specific classroom observations of the teacher and teacher aide classroom actions were made during two consecutive mathematics lessons by the first Author. At intervals of five minutes, the classroom actions of both the teacher and the teacher aide were noted, as were major disturbances (e.g., entrance of a visitor). Initially, in a separate classroom, but in the same school as Classroom 2, all classroom actions were noted and then a check-list template was created to be used in the study classrooms. Additional pedagogical occurrences were added to the checklist where necessary.

Semi-structured interviews were conducted with each teacher and teacher aide. Following each lesson, a joint interview sought information concerning the lesson just conducted and these lasted approximately 30 minutes. Individual semi-structured interviews were conducted with each teacher and teacher aide to seek information about the role of the teacher aide in the classroom. Again these interviews lasted approximately 30 minutes.

### **3.3. Data Analysis**

The general classroom observation sheets were analysed for references to pedagogical contributions. A simple numerical count of the contribution was made on a master tally sheet similar to that used to collect the specific classroom observations. The semi-structured interviews (both individual and joint) were transcribed and coded into categories and recorded on the master tally sheet. The general and specific classroom observations were transferred to the master tally sheet and total classroom actions were calculated.

## **4. Research findings and Discussion**

A summary of the overall results of the classroom actions is provided in Table 1. The actions can be grouped into two categories: the non-pedagogical contribution, and the pedagogical contribution. The non-pedagogical contributions were classified as administration (e.g., roll call to determine attendance at each lesson) and wait time (a period of time the teacher or teacher aide waited for the other to complete a pedagogical contribution). Wait time was more common with the teacher aides as they waited for the teacher to give instructions. The results also show that the most frequent classroom pedagogical contributions performed by teacher aides related to student feedback, behaviour management, classroom organisation, and the linking of the lesson to prior knowledge. For the teachers, the results show the most frequent classroom pedagogical contributions were student feedback, classroom organisation, behaviour management, and the linking of the lesson to prior knowledge. Although the frequencies vary between the two groups (with teachers performing each form of pedagogical contribution more frequently than the teacher aides), the ordering of the actions only varies slightly in relation to behaviour management, and classroom organisation. This is of interest as it indicates that the teacher aides in this study are engaged in instructional interactions, and are in a sense “teaching”.

To probe the nature of the pedagogical contributions being made by the teacher aides in the mathematics classroom, each category was explored at the individual level. Below we use extracts from transcripts and classroom observations to explore the pedagogical contributions of the teacher aide in the Indigenous mathematics classroom.

Table 1. Classroom Actions

Classroom Actions		Teacher Aides N = 3	Teachers N = 3
Non-pedagogical	Administration	2	4
	Wait time	45	23
Pedagogical Contribution	Classroom Organisation	33	45
	Behaviour Management	39	41
	Student Feedback	47	72
	Prior Knowledge Link	32	37
	Questioning	18	31
<b>Total</b>		<b>216</b>	<b>253</b>

The five pedagogical contribution categories presented in Table 1 have been expanded in Table 2 to present a deeper analysis. Classroom organisation contributions related to the organising of either the students or materials. Behaviour management tended to be either proactive or reactive. Student feedback was either task orientated or in the form of praise or criticisms. The links to prior knowledge related to real world knowledge (a desired component of the AIM Project), or to previous lessons. Finally, the types of questions used in the classrooms were found to be either higher order or lower order questioning.

The consideration of both the general and specific classroom observations and the interview data at the individual level was quite revealing. It appears that the teaching team from Classroom 1 skewed the initial results in Table 1. For these two men, there does not appear to be any great differences in their pedagogical contributions.

Table 2. Comparison of teacher and teacher aide pedagogical contributions

	Classroom 1		Classroom 2		Classroom 3	
	Teac	Teac	Teac	Teac	Teac	Teac

		her	her Aide	her	her Aide	her	her Aide
		1	1	2	2	3	3
Classroom	Students	7	6	2	6	12	1
Organisation	Materials	4	6	12	15	4	7
Behaviour	Proactive	8	6	7	8	6	1
Management	Reactive	1	1	1	2	15	8
Student	Affect	12	11	6	3	15	3
feedback	Task	7	10	1	2	8	8
Prior knowledge link	Reality	14	12	7	9	3	3
	Classroom	6	7	3	1	12	1
Questioning	Higher order	2	4	1	0	4	0
	Lower order	12	10	8	3	7	0
<b>Total number of pedagogical contributions</b>		<b>90</b>	<b>86</b>	<b>74</b>	<b>69</b>	<b>100</b>	<b>39</b>

#### 4.1. Classroom Organisation

Figure 1 indicates that in Classroom 1, both Teacher 1 and Teacher Aide 1 are equally active in terms of classroom organisation. Teacher Aide 1 does slightly more work in terms of materials than the teacher, but this allows the teacher to give whole class instruction as well as organise individual students, whilst materials are being distributed. Teacher 1 does not instruct Teacher Aide 1 in relation to classroom organisation. Teacher Aide 1 appears to know what Teacher 1 requires, indicating prior co-planning and conversations between Teacher 1 and Teacher Aide 1. Teacher Aide 1 explained: “We have been teaching together for nearly a year now. I think I understand his teaching style. [Teacher 1] wants the kids to understand the ‘why’ of their lessons. I have a good understanding of mathematics from my own schooling, so I can see where he is heading, and we go there together. It helps that I know the ‘hands on’ ideas first from the PD; otherwise I would need to ask”.

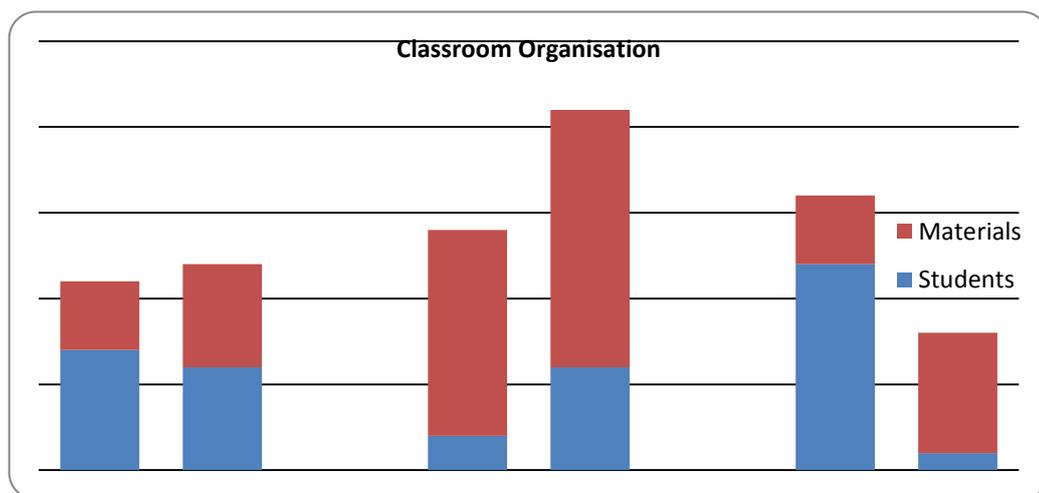


Figure 1: Pedagogical Contributions to Classroom Organisation

Classroom 2 is organised differently. In Classroom 2, it is clearly the role of Teacher Aide 2 is to organise the materials and the students. When materials are needed in the lesson, Teacher 2 gives instructions to Teacher Aide 2 in

relation to distribution or use of the materials. Teacher 2 and Teacher Aide 2 then co-distribute the materials. There is no indication of prior conversations between Teacher 2 and Teacher Aide 2 concerning classroom organisation. Classroom 3 is again different. Teacher 3 is very much involved in organising the students without assistance from Teacher Aide 3. In Classroom 3, the organisation of materials occurs in a similar way to Classroom 2, except Teacher 3 is less involved than Teacher 2 – possibly due to a lot less materials being used in the lessons.

#### 4.2. Behaviour Management

Figure 2 indicates that in both Classrooms 1 and 2, there appears to be significantly more proactive behaviour management than reactive behaviour management, and the proactive behaviour management seems to be a joint responsibility of both the teachers and teacher aides. Teacher Aide 2 explained in her individual interview that “It is all about relationships. Relationships between me and the teacher, then teacher and the [students], and the student and me. If we do not have a good relationship, we will not teach and we will not learn. You need the relationship before the maths”. Teacher Aide 2 went onto explain that she and Teacher 2 were still working on the relationships in the classroom.

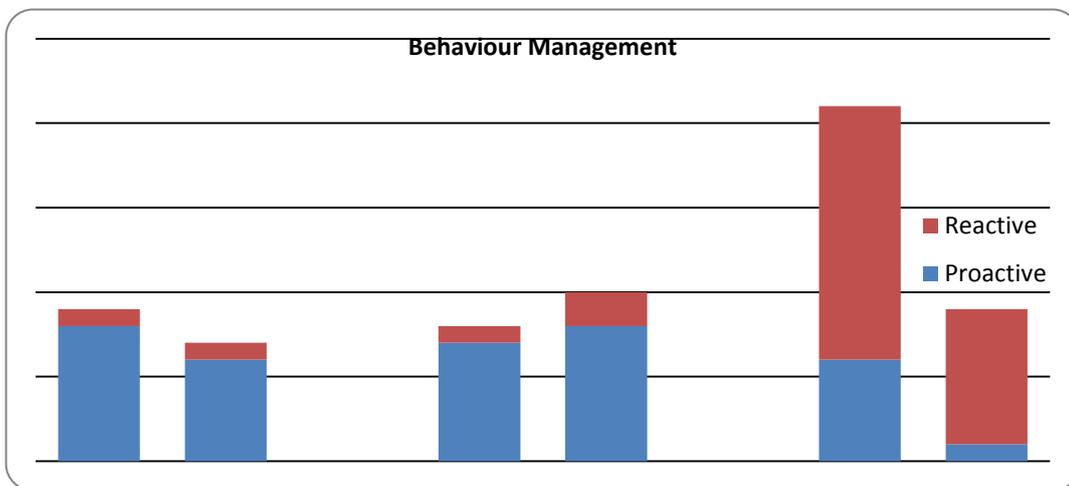


Figure 2: Pedagogical Contributions to Behaviour Management

The general classroom observations indicate an improvement in the social skills of the students in classrooms 1 and 2. In contrast, Classroom 3 has a very reactive behaviour management style. Teacher 3 is largely responsible for behaviour management, and is more reactive than proactive. Teacher Aide 3 has a reactive style that she uses to back up Teacher 3.

#### 4.3. Student Feedback

Figure 3 indicates that in Classroom 1, student feedback was often in relation to the affect (praise); however Teacher Aide 1 is equally likely to give task related feedback. Feedback from both the teacher and teacher aide is often jovial and as a result, the students respond well as they are relaxed and seem to be enjoying their lessons.

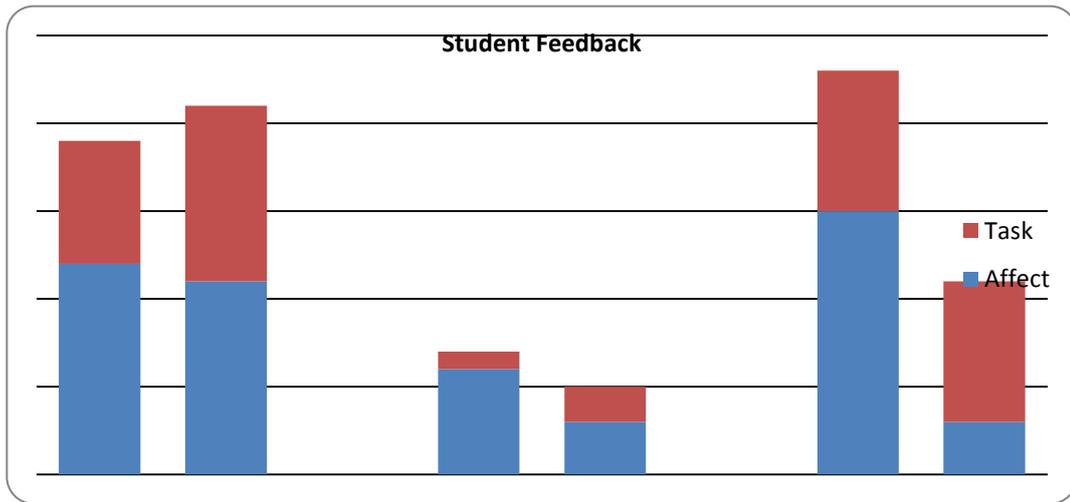


Figure 3: Pedagogical Contributions to Student Feedback

In Classroom 2, not a lot of student feedback is given, but when it is, it is always very positive and constructive – and has a very genuine feel to it. Students respond well. A greater amount of feedback is given in Classroom 3 than Classroom 2. Most of this is provided by Teacher 3; however it is often quite critical of the student or his/her work.

*a. Prior Knowledge Links*

One of the underlying philosophies of the AIM Project is for the mathematics to be presented to the students so that it relates to the real world of the student – that is, it has personal relevance. Figure 4 indicates that both Teacher 1 and Teacher Aide 1 emphasise the reality of mathematics a lot more than they link the present lesson to a previous lesson. As indicated earlier, mathematics is not culture-free; culture is closely connected to the way in which we learn and understand mathematics (Ladson-Billings, 1997). The Westernised style of teaching mathematics by Teacher 1 is being complemented by Teacher Aide 1 who brings to light aspects of Indigenous culture and practices of the Indigenous students relevant to the mathematics teaching and learning process. Linking cultural knowledge to the mathematics lesson is essential with Indigenous learners so that the mathematics becomes meaningful. The lack of experience that Teacher 1 has in the community makes the role of Teacher Aide 1 in the classrooms vital to the educational success of their students. Teacher Aide 1 is working collaboratively with Teacher 1 to bridge the cultural-content gap possibly resulting in better teaching and learning.

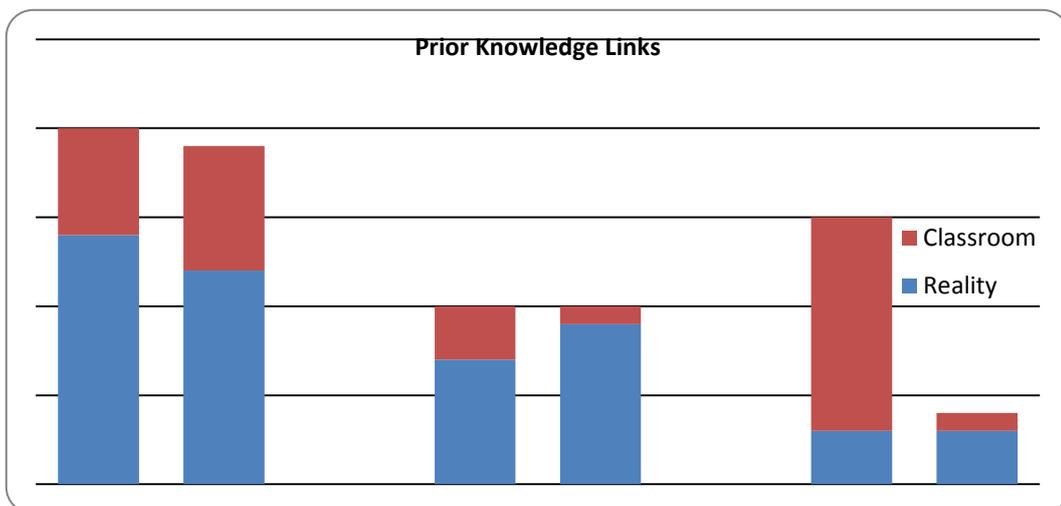


Figure 4: Pedagogical Contributions to making Links to Prior Knowledge

Whilst to the first Author, there was a logical flow between the 2 consecutive lessons observed, this flow may not be apparent to all students. Teacher Aide 1 explained in the joint interview with Teacher 1 that “Sometimes kids need the links mentioned to what we did in a different lesson, but mostly they respond if we make it match something outside school. School maths was not important to them, but now we show it is in their community, they participate more”. Although Teacher 2 and Teacher Aide 2 relate the mathematics primarily to the real world of the student, these links are not as prevalent as those in Classroom 1. Prior knowledge in Classroom 3 is mostly related to previous lessons by Teacher 3, and not to the real world. Very little purpose is given to the learning of mathematics other than what has been presented in previous lessons. Teacher Aide 3 does not assist with making the mathematics relevant.

### *b. Questioning*

Questioning, as seen in Figure 5, is not prevalent in any of the three classrooms. Teacher Aide 2 indicated in her individual interview “Students don’t really respond to questions. There is this shame issue – they do not want to be ‘shamed’ by giving the wrong answer. But the opposite is also true – they do not want the attention if they give a correct answer. The easiest thing is not to use a lot of questions”. When questioning is used in the classroom, it is generally in the form of lower order questioning, but some higher order questions are asked. In Classroom 1, the questioning is generally in the form of lower order questioning, but some higher order questions are posed to the students and they respond with some correctness.

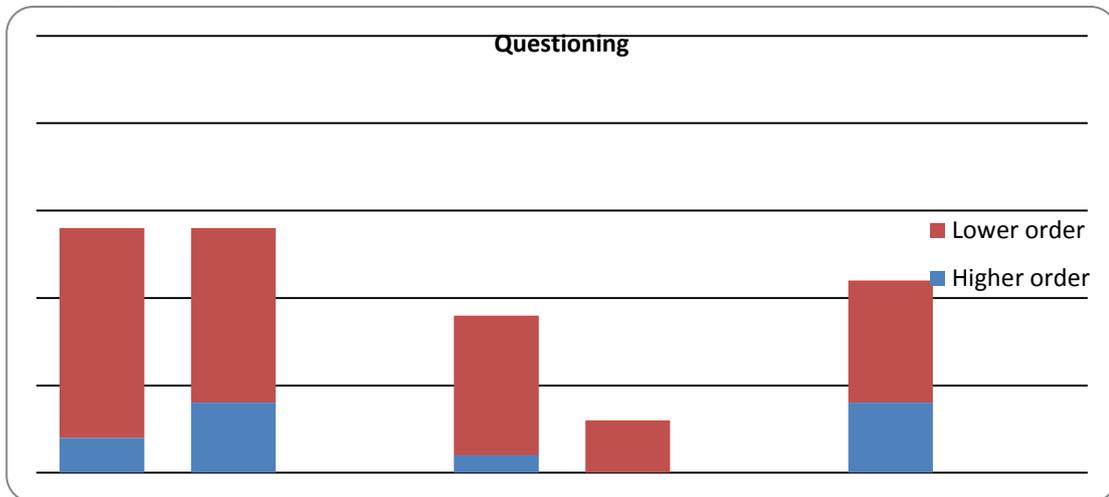


Figure 5: Pedagogical Contributions to Questioning Types

In Classroom 3, higher order questions are asked, but very few, if any at all respond with an answer. In general, for Classroom 2, the students do not seem to respond well to higher order questioning, but Teacher 2 is persevering: “I don’t have their confidence yet. But we are making progress as they will now respond to simpler questions”. Teacher Aide 3 was not observed to ask questions of the students. In her individual interview concerning her roles in the maths classroom she indicated “[Teacher 3] is the teacher and I just help. I don’t do anything without being asked unless it is obvious. I guess I do the running around while she teaches. But when she is away, I teach ... I put notes on the board for the kids to copy; I might ask a question then”.

## **5. Interrelationships between pedagogical contributions**

There appears to be a link between student feedback, behaviour management and questioning. From the observations and interview data, Classroom 1 is a happy classroom, the students are at ease, they are regular attendees to class, and both the teaching team and the students appear to engage in a jovial exchange of knowledge. The students respond to some level of higher order questioning. It appears that in this classroom, Teacher 1 and Teacher Aide 1 work together as equal partners in a dynamic and interactive relationship – a form of co-teaching. Teacher 1 commented in

the joint interview that he values the contributions of Teacher Aide 1. Further research is required to explore the potential benefits of this approach to teaching mathematics to underachieving Indigenous students. Classroom 1 is in stark contrast to Classroom 3 where there is little communication between the students and the teaching team, and between the teaching team. Communication between the teaching team and students is critical in nature and often reactive, and student attendance is irregular for the majority of students. Although Figure 3 indicates similar levels of affective feedback between Teacher Aide 1 and Teacher 3, it must be stressed that affective student feedback can be positive in nature as in the feedback given by Teacher Aide 1, and negative in nature as given by Teacher 3. The quantity of student feedback is not as vital as the quality. It is interesting to compare the lowest need for reactive behaviour management aligning with the highest occurrences of proactive behaviour management, which also appears to align with lower levels of classroom organisation. This also seems to align with high levels of positive affective student feedback, high levels of linking prior knowledge to the reality of the student, and to the emergence of higher order questioning that students feel safe to respond to.

## 6. Conclusion

It is beyond the scope of this paper to attribute the pedagogical contributions of the three teacher aides to learning outcomes of the students. Whilst the student learning data exists, that story remains untold at this point in time. The pedagogical contributions of the three teacher aides varied and appeared to be dependent upon the relationship with the teacher. If the teacher wants to control the class and teach in a traditional manner, then the contribution by the teacher aide will be minimal – as in the case of Classroom 3. Conversely, if the teacher permits the teacher aide to use their initiative, then co-teaching can occur, with the teacher aide making a strong pedagogical contribution to each lesson.

## Acknowledgements

We gratefully acknowledge the teachers and teacher aides in this ‘Closing the Gap’ funded project, who continue to give us their time, professional expertise and access to their classrooms.

## References

- Baturo, A., & Cooper, T. (2004). *Training indigenous teacher-aides and parents to support the mathematics learning of educationally-disadvantaged Indigenous students in junior secondary school* (Report to the Australian Department of Education, Science and Training). Unpublished report, QUT, Kelvin Grove, Australia, 4059.
- Baxter, J., Woodward, J., & Olson, D. (2001). Effects of Reform-Based Mathematics Instruction on Low Achievers in Five Third-Grade Classrooms. *The Elementary School Journal*, 101(5), 529-547.
- Cooper, T., Baturo, A., & Warren, E. (2005). Indigenous and non-Indigenous teaching relationships in three mathematics classrooms in remote Queensland. In H. L. Chick & J. L. Vincent (Eds.) *29th Annual Conference of the International Group for the Psychology of Mathematics Education*, 2005, Melbourne, Australia.
- Groom, B. (2006). Building relationships for learning: the developing role of the teaching assistant. *Support for learning*, 21(4), 199-203.
- Howard, R., & Ford, J. (2007). The roles and responsibilities of Teacher Aides supporting students with special needs in secondary settings. *Australasian Journal of Special Education*, 31(1), 25-43.
- Ladson-Billings, G. (1997). It doesn't add up African American students' mathematics achievement. *Journal for Research in Mathematics Education*, 28(6), 697-708.
- Matthews, C. (2003). *Notes on teaching Indigenous students mathematics*. Unpublished paper, QUT, Kelvin Grove, Australia, 4059.
- Rubie-Davies, C.M., Blatchford, P., Webster, R., Koutsoubou, M., & Bassett, P. (2010). Enhancing Learning? A comparison of teacher and teaching assistant interactions with pupils. *School Effectiveness and School Improvement*, 21(4), 429-449.

- Walther-Thomas, C., Bryant, M., & Land, S. (1996). Planning for effective co-teaching. *Remedial and Special Education*, 17(4), 255-265.
- Warren, E., Cooper, T. & Baturo, A. (2004). Indigenous students and mathematics: Teachers' perceptions of the role of teacher aides. *The Australian Journal of Indigenous Education*, 33, 37-46.