

Aboriginal Educators' Views Concerning the Learning and Teaching of Mathematics

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There has been no reported investigation in mathematics education involving the views of Aboriginal educators about the learning and teaching of mathematics for primary school Aboriginal students. This paper reports on such an investigation. It concentrates on two interviews with Aboriginal Education Assistants teaching in a geographically remote primary school in New South Wales. These two Aboriginal educators identify the importance of personal relationships, relevance and humour in the learning and teaching of mathematics to Aboriginal students. They set a pedagogical agenda for teachers in their interaction with Aboriginal students and communities as they facilitate the learning of mathematics.

Introduction

Across Australia, colonisation has destroyed much of the Aboriginal and Torres Strait Islander culture. Until recent times, anthropological studies had inferred that Aboriginal people had little if no mathematics in their culture (Crawford, 1863; Dixon, 1980; Blake, 1981). Over the last 208 years the Aboriginal peoples of Australia have experienced conquest, integration and assimilation. The learning of school mathematics by Aboriginal and Torres Strait Islander students has taken place in this context. Until recent times, little attention has been given in Australia to the contexts in which Aboriginal students learn mathematics. Social and cultural factors influence the development of people's beliefs, attitudes and values about mathematics and it is in the environment of the mathematics classroom that these factors impact upon the learning and teaching of mathematics (Lerman, 1994). Teachers need to be sensitised to the fact that Indigenous people and people from varying cultural backgrounds may have a view of mathematics and mathematical concepts quite different to those contained in the accepted mathematics curriculum (Rinni & Rinni, 1992).

Mathematics and Cultural Influence

Many mathematics educators hold the view that students bring "*with them different competencies in, and conceptions and beliefs about mathematics*" (Mtetwa & Jaji 1992, p.7). The view that people develop their own perceptions about the nature of mathematics is certainly different from a universal notion of mathematics. All cultural groups have developed their view of mathematics and its relationship to the events that happen within their lives (Bishop, 1988; Lave, 1988; Mtetwa & Jaji, 1992).

It is necessary to investigate Aboriginal peoples' views of mathematics, in order to be able to build effective bridges from the "*indigenous mathematics to the new mathematics to be introduced in schools*" (D'Ambrosio 1986, p.6). In undertaking an investigation of Aboriginal people's views about mathematics one needs to include an appreciation of:

- * the social, cultural and historical diversity of Aboriginal communities,
- * respecting and valuing Aboriginal people's views of learning,
- * listening to Indigenous people's views towards learning,
- * the importance of recognising Aboriginal people's views of mathematics,
- * how Aboriginal people relate to mathematics, and
- * how Aboriginal people use mathematics.

As displayed in most curricula, there appears to be only one mathematics. There are several mathematics. However, there are social and political implications for cultures who do not own the one mathematics as prescribed in a set curriculum. Each culture has developed its

own view and concepts of mathematics. Their world view of the place of mathematics in the environment about them has influenced their thinking about mathematics. Such thinking leads to a set of mathematical beliefs, attitudes and values. As cultures become more aware of each others' views they further develop their own view of mathematics. As individuals learn, evaluate and discard notions their view of mathematics develops, modifies and changes. A cultural view, as an individual's, will evolve with time.

In some communities there may well be several views of mathematics held by differing groups. Aboriginal people may hold many differing view of mathematics than other groups within the community. The diversity of Aboriginal groups within Australia may have resulted in many views of mathematics being developed. The views held by coastal communities may differ from inland groups. Those views held by rural people may differ from urban and geographically isolated communities. Many of these views may differ from non-Aboriginal groups within Australia.

Much of the present teaching of school mathematics, particularly in the primary years, has Aboriginal students doing mathematics that is not related to their world and their everyday experiences (Graham, 1988). By the time that many of these students have reached the latter years of primary school they have been alienated from mathematics. The students can do the sums, addition, subtraction, multiplication and perhaps division but they do not feel in control of the mathematics and particularly the language of mathematics that is being used. School mathematics is taught and learnt through a language that has been developed by the dominant culture. Often student success is dependent upon and measured by how well the meanings of this language of mathematics are grasped.

Conflicts between groups who have differing world views of mathematics may be identified by one group and not accepted or even seen by the other (Barton, 1992). Such conflicts can give rise to one world view of mathematics being seen as superior to the other. This latter view was often the approach to mathematics taught in colonised countries. The mathematics achievement levels of people in such countries has been acknowledged as a major concern.

In not appreciating Aborigines' views concerning the nature and conceptual notions of mathematics and a lack of consideration of Aboriginal learning styles in the varying contexts in which Aborigines live little value, in the past, has been given by curriculum developers and educators to their world view of mathematics. By not allowing Aboriginal or culturally based education into the mathematics curriculum, Aboriginal students have been disadvantaged both in their schooling and in the development of their own ideas and patterns of mathematical thinking (Mtetwa & Jaji, 1992). More respect and regard needs to be given to the mathematics of Indigenous peoples and the issues related to their learning of mathematics in the various education sectors.

Through not :

- * appreciating the nature and conceptual notions of mathematics of Aborigines,
- * valuing their learning styles and the context in which they lived, and
- * allowing culturally based education into the mathematics curriculum

Aboriginal students have been disadvantaged in their schooling through teachers not appreciating their understanding of the nature of mathematics and in the lack of development of relevant mathematics curricula. Aboriginal people have called for appropriateness and relevance within the curriculum as they acknowledged the role of the dominant society in curriculum development and control of the curriculum content.

The content element of curriculum development is given much attention by sensitive non-Aboriginal teachers as well as Aboriginal educators. There is a constant need to evaluate the quality, accuracy and appropriateness of the content of material used to teach about Aboriginal society and to teach Aboriginal children. A critical analysis must be maintained at all costs. It needs to be recognised that curriculum is shaped by the dominant society, which in this country is now Anglo-Saxon .

(National Aboriginal Education Committee 1985, p. 8)

The introduction of Aboriginal learning styles into schools and the mathematics classroom needs to be done by and in co-operation with Aboriginal people. Such co-operation between the community, students and educators can help bridge the difficult social and learning experiences that many Aboriginal students face in learning mathematics. Through being involved in the curriculum decision making processes of the school Aborigines bring to the school their perspective and their identity.

For many Aboriginal and Torres Strait Islander children the knowledge they bring with them to school and the language they use is not part of the culture of a Western based mathematics class. Yet, it is too simplistic to suggest language and cultural factors are the only reasons that Indigenous students are not achieving their potential in mathematics. *'Aboriginal children are being taught mathematics in our schools, but they are not learning the things that matter. Such knowledge is not just to do with getting sums right, though that is part of it. Rather, it is to do with the way people talk and think about what they know'* (Graham 1988, p. 132). Time needs to be provided for children to develop mathematical meaning through action in real life experiences, in discourse about those experiences and in reflection of what they have learnt needs to be provided.

Teachers and curriculum developers are becoming more aware of the cross-cultural situations that exist in our classrooms from pre-school to tertiary level. Harris (1991) has indicated that there are difficult challenges for the teacher to meet when teaching mathematics in cross-cultural situations but they have to be met and well answered for the continued empowerment of Aboriginal people.

There needs to be *'in class'* and *'out of class'* investigations of the sociocultural contexts in which learning mathematics takes place. One suggested area of research has been *'to obtain a more elaborate picture of teachers' knowledge, beliefs, judgements, and decisions as they apply to their diverse student populations and as related to their notions of equity'* (Secada 1992, p. 22). This comment has been extended, in this study, to investigate the views held by Aboriginal students, educators, parents and their teachers towards the learning and teaching of mathematics and the reporting of those views in the terms used by the people interviewed.

Methodology

In New South Wales primary schools there are a number of Aboriginal people employed as Aboriginal Education Assistants (AEAs). AEAs are appointed to schools to assist with the teaching of Aboriginal students and the implementation of Aboriginal perspectives across the school curriculum. The number of AEAs in any one school depends on the number of Aboriginal students enrolled.

This paper draws on data collected during 1994 which was part of a nine month ethnographic study involving Aboriginal students, parents educators and teachers living in a remote country community in New South Wales. Over a period of 6 years the author had come to know the community and be known by the Aboriginal educators working within the schools (Cutmore & Howard, 1995). Conversational interviews were conducted with 11 participants. This paper reports on the interview conducted with two Aboriginal Education Assistants, Sandy and Phil [pseudonyms]. For this interview, a set time was agreed upon and the interviewees selected the location. Sandy and Phil preferred to be interviewed together and agreed for the interview to be audiotaped.

Analysis of Aboriginal Educator's Interviews

Interviews were transcribed and reviewed using a constant comparative method (Glaser & Strauss, 1967). From the transcript reviews, seventeen categories were identified and used to analyse all the interviews. Not all seventeen categories were identified in each interview. There were six categories identified in Sandy and Phil's interview.

Relevance: identifies comments related to how meaningful participants find mathematics to them.

Emotions:	relates to me and mathematics. This category identifies how an individual feels about mathematics, thinks about mathematics and how it relates to them.
Language:	identifies those comments related to role of language and mathematics.
Contexts:	identifies issues related to the social, cultural, economic, historical and political contexts in which the learning of mathematics takes place.
Teaching:	identifies comments related to the organisation of teaching and learning activities.
Family	identifies concerns and values that are held by family members Concerns: towards learning and mathematics.

Relevance

Sandy and Phil believed that mathematics was very important for Aboriginal children. Phil spoke about the fact that mathematics was all about you, yet often the students did not know that the things they see about them involve mathematics. It was obvious that both Phil and Sandy could identify many instances of the presence of mathematics in the lives of the students.

*Phil: We do maths everyday. We don't know that we do. When you look around a room. What shape is that there? Window obviously a square. What shape is a car? We say like a box. Things like that. But mate they don't know that the things they see around is involved with maths.

*Sandy: Just walking to school.

*Phil: Navigating their way home.

*Sandy: Then at home like cooking, you know.

*Phil: Putting two eggs into the cake or something like that.

*Sandy: They don't realise

*Phil: ... that's maths.

Sandy and Phil thought it would be good for children to go into the community to identify the mathematics being used. This would be very different to what happened in the mathematics at school.

*Sandy: It would be good for the kids to go out into the community where they could see things and maybe to explore.

*Interviewer: Do they do much now?

*Sandy: No not really. It's mainly just in the class. All you see is stencils.

Emotions

Phil and Sandy did not know if the students worried about mathematics but they did believe that the mood that a child was in when they came to school influenced their learning of mathematics. Phil said that students would use strategies to avoid doing mathematics and identified some that were used.

*Interviewer: Do kids here get worried about maths?

*Sandy: I don't know really.

*Phil: It depends on how they come to school really isn't it? If they come to school in a good mood I don't think they'll worry about it. But if they come in a bad mood they'll chuck a sickie or go to the toilet, ask can I go and have a drink during the lesson and then they miss out on an important part.

*Sandy: Yeah it probably depends on their mood.

Language

Sandy believed that Aboriginal children were good at mathematics but that it was the language in the form of long words, students' lack of understanding of the words that are used when they are writing that makes mathematics hard for them.

- *Interviewer: The long words are a problem?
 *Sandy: Yeah.
 *Interviewer: In what ways do you think?
 *Sandy: Probably because they don't understand them.
 *Interviewer: That's a big issue. The kids are good at maths.
 *Sandy: Yeah.
 *Interviewer: But they find it hard when it's writing?
 *Sandy: Yeah, you know the words that are used and that's where they fail because they don't understand.

Sandy believed that the language of the test was a major reason for Aboriginal children failing in mathematics tests.

- *Sandy: ...a lot of them find it hard to do especially with the maths cause of the language, you know they fail. A lot of kids are good at maths but when they see it in writing what they got to do they find it hard.

Context

The contextual issue of identity, of being Aboriginal, was seen as an important pedagogical issue when teaching mathematics to Aboriginal children. Sandy and Phil were firmly of the opinion that Aboriginal children learn better if concrete materials are available. They believed that it made mathematics clearer for the students helping to overcome the language difficulties of writing, teacher expressions and long words.

- *Interviewer: How important is the Aboriginal culture issue ?
 *Phil: Real important I reckon. Different cultures have different ways of saying that kids have to learn this way and that way and with Aboriginal culture I think the most important thing is hands on stuff. Kids learn better I reckon that way.
 *Sandy: Yeah.
 *Phil: It just seems clearer to them than all this writing on the board and you know teacher expressions and big words.

Teaching

Phil also talked about the importance of fun and humour in learning. He believed that the students should focus on their work and be rewarded for the work that they did. Phil believed that as the students realised that they could do the work it would make them want to do more.

- *Phil: You got to have fun in doing the subjects and that goes right across the curriculum. If all the kids have fun doing their stuff when they come to class, get down, knuckle down and do a bit of work and then have free time as a bit of a reward. ... If the kids know yeah I finish this, yeah that's good, yeah I can do this then. It sort of makes them knuckle down a bit more. If you just go into the classroom and have a dull, old stencil then they'll just sit there and take their time. You've got to reward them in the end.

Phil was not supportive of the use of stencils and Sandy believed that the children get bored and do not want to listen. Phil really believed that learning should be fun and that in mathematics there was none that he saw.

- *Sandy: Yeah they don't want to listen. Get bored. They turn off.
 *Phil: Some of the kids they sort of want to have fun when they are doing their learning activities and if there were a funny part about maths they'd learn good.
 *Interviewer: Do you see much fun going on in mathematics?

*Phil: None mate, no. (Laughter)

There needed to be thought given to the structure of a mathematics lesson for Aboriginal children. Phil had already spoken about stencils and the need for more hands on material. The issue of students misusing the manipulatives was raised and Sandy believed that the teacher just had to be consistent and that the relationships between the teacher and the students had to be positive. The role of the teacher and their relationships with the students was seen as a crucial influence on Aboriginal students' learning.

*Sandy: The students have to get on good with the teacher and know that teacher.

*Phil: Yeah. A lot of kids don't like the teacher cause the way they teach it, or the way they are or the way they look.

*Sandy: A lot of kids if they hear a teacher growling they say I don't like that teacher. You say why and they say because they growl.

*Phil: If they are consistent with the students they would see down the road that if you play up you're going to get roused on. It's hard being consistent with kids every time. Sometimes I know that some of the kids want you and they don't want you to be with other kids. You can pick them and sort of dodge them and say I have to look at these kids first.

Phil was strong in his belief that relationships was the most important variable in children's learning yet he was honest in saying that it is not an easy thing to change.

*Phil: I think the relationship is number one. Then you break down the barriers and you slide it into their system that you can't do this at school. You don't go off or nothing like this You can't change things that have been around for ten, twenty years in one little short term.

Family concerns

There does not seem to be the support from home for the school. For Sandy and Phil there needed to be more community involvement to support the children's learning.

*Interviewer: I've yet to meet a parent who doesn't want their children to learn and I'm yet to meet kids who don't want to learn. How do we get them learning at school?

*Phil: More community involvement in the school like in the classrooms. Teachers and parents coming and sitting in the class and helping them with their work and saying you did good today with maths and English. Being positive always.

Though, Phil was committed to the belief that community involvement would help the children at school he identified the need for the school to create a more relaxed atmosphere for the parents, for most of them had set views on how they were supposed to behave in school.

*Phil: I think for the parents, too, when they come up to school they think oh we're in school now we've got to behave like this (Said in a whisper). If kids go into the community and get the parents involved it's in a more relaxing atmosphere, isn't it?

Discussion

There was a stated need to make mathematics more relevant to the students. The students needed to be able to recognise mathematics in their activities outside of school and in those that they saw about the community. The Aboriginal Educators believed that mathematics had to not only be made more relevant but structured activities had to be set up

for the students to identify mathematics in what they did themselves and what they could see in their community.

Phil and Sandy raised the emotional issue of one's mood and how it influenced a student's learning. Coming to school to do mathematics in a poor mood could lead to the students using avoidance strategies when it came to doing mathematics.

Though much has been written about the language difficulties experienced by Aboriginal students (Graham, 1988) these Aboriginal Educators still identified teacher expressions, writing and the students understanding of long words in mathematics as constraints to students learning mathematics. The language of and in the mathematics classroom continues to be of major concern for these Aboriginal educators for, they believe, it does lead to student failure.

For Sandy and Phil, teachers needed to acknowledge that the learning of mathematics by Aboriginal children is fostered through the students using concrete materials. They believed that the materials helped to make mathematics clearer, overcoming some of the language difficulties of writing, teacher expressions and long words.

Teaching was given special focus by Phil and Sandy. They identified that consistency, positive relationships, teaching style, teacher's body language and open communication as important factors in fostering effective learning overall and in mathematics in particular. It was important to be consistent and the children needed to be told what was happening in their class. The prime factor for Phil was positive teacher/student relationships. Both Sandy and Phil were united in the view that learning mathematics should be fun and that currently they did not see much of that happening.

These two Aboriginal Educators recognised the need for more community involvement to support children's learning. Though, many of the parents are anxious to become involved in schools from past experiences and that a relaxed atmosphere has to be fostered within schools and that children working in the community may indeed be one way to have the community become more involved.

Conclusion

For mathematics educators a knowledge and sensitivity to the historical, psychological and social contexts in which Aboriginal children learn mathematics could only but benefit the Aboriginal student's learning. The classroom for many Aboriginal children in the senior years of primary school becomes an alien place comprising tension and conflicts about relationships and the value of what they are being taught. Relationship between the teacher and the Aboriginal student has been identified by these two Aboriginal educators as a crucial element for the effective learning of mathematics to take place.

The history of and the effect of the imposition of a Western education and its mathematics on Aboriginal children is an issue that needs to be raised in teacher education courses, induction programs for teachers and their continuing professional development. Such an inclusion would better prepare mathematics educators to better understand the complex nature and culture of the mathematics classroom for many Aboriginal students.

Aboriginal students want to learn mathematics, they want to do well and they want to maintain their identity. This has implications for the overall mathematics program of any school with Aboriginal students. Teachers need to develop teaching strategies that address the Aboriginal child's learning of mathematics as well as their identity. The evaluation of the quality, accuracy and appropriateness of the mathematics curriculum for Indigenous students continues to require attention.

In future reports the views espoused by these two Aboriginal educators towards the learning and teaching of mathematics will be supported and expanded through the comments of other Aboriginal educators as well as Aboriginal students, parents and their teachers. Together, they present a holistic view of learning and teaching.

Their views were wide ranging. They felt free to express them and it was important to them that they did so. There is no easy solution to the difficult issues facing Aboriginal students learning school mathematics and Aboriginal educators in teaching school mathematics. Already the issues of language, relationships and one's identity in the learning

of mathematics have emerged together with specific comment on pedagogical aspects including fun in mathematics, the influence of one's mood on learning and the need for teacher consistency. Through open conversations both the pedagogical issues and possible solutions as perceived by those involved in the learning process can be voiced.

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