

Maths as a Cultural Practice in a Remote Aboriginal Community

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1 Introduction:

When SiMERR NT had the opportunity to undertake a small research project in the area of 'diversity' in education, we decided to focus on mathematical understandings and practices in a remote Aboriginal community including its school. We were keen for the project to be a collaboration between a group of CDU researchers, and senior Yolŋu (Aboriginal) educators, interpreters and consultants so we planned for a two day workshop where key issues could be canvassed and some ways forward agreed. We called the workshop 'Maths as a Cultural Practice' (MACP).

Two research interests came together in this workshop. We are involved in an ARC Linkage project on Aboriginal maths education and, we are interested in the professionalisation of Yolŋu consultants and the sorts of work which needs to be done when agreements are made between different cultures.

2. The ARC project: Building Community Capital.

Most of the Yolŋu consultants at the MACP workshop were from Galiwin'ku on Elcho Island in northeast Arnhemland, where we have a longstanding relationship with interpreters and consultants, and where the ARC Linkage research project is being conducted at Shepherdson College, the community school. Galiwin'ku is one of the largest Aboriginal settlements in the NT, and its lingua franca 'Western Dhuwal' or 'Djambarrpuyŋu', is the second mostly widely spoken language in the NT after English. The ARC project is called '*Building Community Capital to Support Sustainable Numeracy Education in Remote Locations*' (BCC) and has as one of its aims, the involvement of community members in the maths education of young Yolŋu children at school.

A core part of the BCC project is the use of a set of 'probe tasks' whereby teachers (and 'knowledge keepers') who have an understanding of the progressions which are said to mark the development of Western mathematical capability (and 'knowledge'), can assess the various stages which youngsters have attained through their schooling. They include 'subitising' (being able to recognise small quantities without counting) 'part-part whole knowledge' (ability to name numbers in terms of their parts without counting), 'partitioning' (a form of visual division), 'trusting the count', 'mental strategies', 'place value' (understanding the ways in which units, tens, hundreds etc are arranged in the names and symbols representing numbers) and so forth. The probes require children to perform particular tasks (responding to flash cards, arranging counters into groups, pegging numbers on a number line etc), and asking students to talk about what they have done in the tasks.

The project involves working with Yolŋu teachers and community members to train them in the use of the tasks as a diagnostic. This aims to give the Yolŋu teachers and community members some source of authority in the classroom, where they work

with Balanda teachers who often stay in communities for relatively short periods. (Balanda is the Yolŋu word for European.) The children's performances on the tasks point to particular teaching strategies and classroom activities aimed at producing and consolidating the knowledge required for the various stages of development.

The tasks have been derived from a number of sources within western maths education, and one of the aims of the BCC project is to see how useful they may be for Aboriginal teachers in Aboriginal classrooms. After a year working on this collaborative project, some important issues have emerged. Some of these have led to proposed changes which may transform pedagogy, the focus of this conference report. Before moving on to a discussion of the SiMERR workshop, I will elaborate a few of these underlying assumptions which have been challenged as the BCC project has unfolded.

The use of probe tasks depends upon a classroom routine in which maths activities in the early years are performed on a daily basis, and then once a week (or fortnight) the teachers intervene with a probe task which allows them to work out where the child is in her progress, and therefore what are the best activities to concentrate upon during the maths activity sessions. It is not clear in this school whether the everyday classroom maths activities upon which the probe tasks in a sense depend, are regularly practised. Nor is it clear that they are indeed the most useful sorts of everyday activities for classroom maths work in an Aboriginal school.

Furthermore, there is some problem with the divide between testing and teaching upon which the probe tasks depend. The researchers consider that it is wrong for the teachers to use the tasks as an opportunity for teaching, yet the Yolŋu teachers don't seem to be able to resist. Is there something in the principles of Yolŋu pedagogy which gives rise to this reluctance?

Finally, the success of the probe tasks requires that teachers ask children to explain or justify their performance verbally in response to questions like 'Can you tell me why you did that?' This is argued on the grounds that the teachers must monitor the conceptual development of their students. But the children are very reluctant to give explanations, the Yolŋu teachers don't spontaneously ask probing questions, and all the while we see an ongoing almost obsessive search on the part of balanda educators and researchers for appropriate Yolŋu language terms to use in questioning children who don't speak English. (I am personally implicated in the long history of that dredging and engineering, having been a teacher linguist in Yolŋu schools for many years.)

3 The Maths as a Cultural Practice workshop

Ten senior Yolŋu consultants came to Darwin for a two day workshop to discuss maths in Yolŋu life at home and at school. Some were from small homeland centres, some from the larger community of Galiwin'ku.

The BCC project was not referred to explicitly during the workshop and there was no formal agenda. Our aim was to replicate as closely as possible the traditional Yolŋu practices of agreement making through discussion which is often circular and wide-ranging. Most of the discussion was in Yolŋu languages with liberal sprinklings of

English. Details of the participants and a complete transcript and translation of two days of what they had to say, are available on the website www.cdu.edu.au/macp.

The discussions were friendly, often very funny, sometimes expressing deep concern, frustration and disappointment. What I have summarized below responds, I hope, to some of the issues emerging in the BCC project and to the SiMERR conference theme of ‘transforming pedagogy’.

Yolŋu maths

There was from the beginning of the workshop, a strong ongoing emphasis, insistence and celebration of what is known as ‘Yolŋu maths’. Dhaŋgal, the interpreter began with the flat statement; “Whatever Yolŋu do in their culture, there is maths in it”. Her first examples were the sacred designs (which are very geometrical and link natural phenomena to socio-political structures), the inmixing of water currents (which is totemically very important to relationships enacted through Yolŋu religion), and the complex Yolŋu kinship system. Nearly all of the participants had an example of Yolŋu maths to give: Waymamba the university lecturer gave an example of dividing up loaves of sacred cycad bread – a Yolŋu type of division which must be done carefully, respectfully, under the supervision of ceremonial leaders, in the right place, and at the right time of year. Later Frank contrasted the Yolŋu maths of cycad division with learning balanda maths in the classroom through the analogy of going into a shop and buying mangoes out of season.

Gotha, the homeland elder emphasised the knowledge to be gained from understanding the relation between the cycles of the moon and the cycles of spring and neap tides, the cloud types and the collaborative decision making of everyday life. She said that when children are taught maths without engaging with the environment it ‘makes them thinking in boxes’. Children can only learn properly on traditional land, where they have a ‘settled head’ which comes from living life where you can see your land, you are surrounded by kin, you see the moon and stars every night, you can see the tides going in and out, when the wind blows, when it stops, when the mosquitoes start, “the things the land is teaching us”. She told us about her trip to Canberra where she had seen the flag above the new parliament house and had wondered to herself, where is the foundation for the curriculum which comes from Canberra? Her granddaughter Gurraŋgurrarŋ who teaches in the small homeland school spoke of her success teaching maths outside the classroom, measuring distance, calculating proportions of oil for the generator, tallying eggs etc.

Bringing home numeracy to the classroom

Gapany the school teacher praised Gotha, saying she had learnt her Yolŋu maths from her. Only now as she is getting older is she getting to understand the depth of Yolŋu maths. She talked about her own children at home as they did their Yolŋu maths around fishing and the cycles of knowing, observing, deducing, coming and going, getting bait, looking for shellfish, waiting for the tide. Towards the end of the two days she remarked at how the workshop discussion on Balanda and Yolŋu maths had helped her realise what was lacking in the way she had to approach maths education at school.

Frank remarked that when we bring the maths we do at home into the classroom (sorting eggs for example) your maths will be ‘very good’. He made clear that the Balanda maths system and the Yolŋu maths system do not map neatly over each other. They never will, but Yolŋu use Balanda number in everyday Yolŋu life, they just need help to do it better.

Maratja the translator said Balanda maths is so powerful (with scientists going to the moon) that if we don’t set it up so that two systems can recognise each other, the Yolŋu kids will grow up thinking their traditions are crooked, or lacking in some way, and they’ll end up in some strange undefined place.

Both Maratja and Frank said that it was not until they got back to work in the community from their high schooling in Darwin, that they really understood the maths they had learnt at school. The school maths in their day was so abstracted – Maratja said ‘alienated’ - from everyday life that it didn’t make sense when they returned home to community life.

Maratja remembered his own schooling, ‘we used to go from simple to quite hard, but there wasn’t any connection to our environment, to help us understand, it was vague, like from a different world. No contextualising with our everyday life experiences; there was no grounding, or good foundation. It was not breaking through to us.’

Frank used the metaphor of getting lost in the mangroves. At every point in your journey, you need to have a keen sense of where you are, where you have come from, and which way you will need to go to get back to the Toyota. Students may understand where they start in their schooling but they soon get lost, they can’t find their way back home to Yolŋu life.

Maratja the translator talked about finding yams in the jungle. You start by finding the leaf, but you must trace the fine vine stem all the way back through the jungle foliage and prickles to find the yam. If at any moment the stem breaks off, you will lose sight of the connection back to the food source and miss out on your dinner.

Ethics and pedagogy

Children can not learn to do balanda maths unless they have received a firm *foundation* in their own Yolŋu culture. That was possibly the most commonly reiterated position over the two days. The Yolŋu word for *foundation* is the same as the word for *footprint*, and is tied up with a history of embodiment on the land. Language is strongly related to land in Yolŋu epistemology (different languages belong to different areas of country or vice versa) and all the many known and owned places are said to know and to speak. So Maratja the experienced translator referred to language as the ‘key entry point’ for a good maths pedagogy.

Rose the Darwin interpreter argued that the key reasons for beginning a child’s education with a grounding in Yolŋu knowledge is because ‘it teaches respect at the beginning’.

Such ethical aspects of Yolŋu pedagogy were emphasised throughout the two days. Maratja began the first day by talking about *value*, using the Yolŋu word *miŋurr*,

which could be translated as *precious*. What do we value in education? Schooling emphasises Balanda value. How do we bring Yolŋu value into the school – how do they mix (using the metaphor of two river/sea currents coming together into one). If we understand the two extremes, we can bring them together. He tied the failure to address questions of value to the high drop out rate from school, and to the way in which Balanda culture in school and community blinds and alienates young people from their Yolŋu identity.

If children are to become ‘analytical and problem solvers for the community’, said Maratja, we need to talk over those issues so they are not caught up in a system where ‘there isn’t any value inside there for our children’. Maths in the classroom is a problem because it is alienated from our commitment to work confidently and respectfully together, to help our relatives, because old people are there (checking up on us). Do the job right or there’ll be trouble! He drew the link between climate change and drought in southern states and education which doesn’t have value and respect built into it, leading to abuse of the land.

This alienation causes problems for Yolŋu teachers. Gapany, after talking about how comfortably young people use Balanda maths in the home, and how awkward they find it at school, admitted that she is actually frightened of teaching maths in the classroom because she isn’t confident that she is making a properly supervised contribution to their knowledge. She is afraid she will produce confusion in their heads.

Balanda are always encouraged to be asking questions. Yolŋu kids ask questions at home because they have the right kin to ask and feel very safe. Mixed up with other kids and with teachers who are not part of their immediate family, kids feel that it’s rude to ask too many questions. “That’s how we feel inside ourselves”. Gapany thought the kids were learning more maths at home – at the washing machine and the kitchen sink – than at school. They certainly ask a lot more questions at home. They know it’s not right to ask too many questions at school.

How do we know we know?

Waymamba, the Yolŋu lecturer focussed upon the way in which both Yolŋu and balanda mathematics systems rely on the use of names. However these names are not the same as the ideas inside people’s heads. They are very different. The things inside balanda heads are quite different than the things inside Yolŋu heads. And later Gapany, the school teacher reminded us that the things inside different Yolŋu heads are crucially different, depending on their ancestral connections (*riŋgitj*) to this or that place or this or that totem.

Maratja suggested that the Yolŋu are thinking globally whereas balanda seem to be more linear, systematic, even though the two systems are separate, they are two extremes, they are complementary, and now we can work together we can sit down and talk and come up with some agreements, sometimes we agree, then we talk.

4. Discussion: Always knowing your way home

Maratja talked about finding a way to understand the two extremes of Balanda value and Yolŋu value in a search for good maths pedagogy, 'the foundations by which we can understand each other need unravelling, straightening up, as a way for us to recognise each other'. There is important philosophical work to be done here, and a methodology to be developed which remains faithful to the ethics and metaphysics of both systems. A big project, which we may find time and funding and commitment to pursue over coming years.

In the mean time, however we need to agree to a some fundamental principles for going on together in the everyday scramble of classroom life in a large Aboriginal community. Like Frank in the mangroves, as we go out in the world (and the classroom) discovering new things, how do we make sure we always know our way home?

Significant work linking Yolŋu maths to Balanda maths through the development of a both-ways 'garma' curriculum was done at Yirrkala in the 1980s under the guidance of Deakin University philosopher Helen Verran, now at the University of Melbourne. Yirrkala is hundreds of kilometres from Galiwin'ku but the Aboriginal owners of the two communities share a common Yolŋu heritage with related languages and clan groups in a network of kin and political and religious relationships. It is difficult to tell the extent to which the Galiwin'ku Yolŋu understanding of Yolŋu maths has been influenced by the Yirrkala work, but Yolŋu maths was a theme to which the Yolŋu consultants returned constantly over the two day workshop. In the Yirrkala curriculum, much was made of the connections between the Balanda system of numbers, and the Yolŋu kinship system as parallel recursive naming practices which provide order and value to Yolŋu and Balanda reality. (Yolŋu kinship is a system which refers not only to human beings, but to estates, languages, totems, species etc which relate as kin). In the garma curriculum the two practices are placed side by side in a 'both-ways' pedagogy where samenesses and differences are identified and practised.

The Galiwin'ku consultants' emphases, which I have tried to summarize in section 3 above, were not so much to do with what we might see as the rationality of Yolŋu maths (although that cannot be denied), but more to do with the way in which it produces a particular sort of value which is key to the proper education of young people. Or it might be better to say that Yolŋu maths produces a certain sort of Yolŋu who is at home in her world, who doesn't get lost or disoriented, who knows her place and respects her kin (including the land and what it holds).

The Yolŋu consultants made clear that it is those routine practices of Yolŋu life which produce strong Yolŋu. In what sense are they missing from balanda maths? The Yolŋu identification of environmental problems in southern states (and the absurdity of curriculum delivered from Canberra) make explicit a link between learning to do maths properly, and learning to be a responsible person.

It also points to an issue with conventional understanding of good maths practice as contingent upon the prior acquisition of maths *concepts*: abstract foundational assumptions that numbers are out there, ontologically real, a key to a true

understanding of the world. Yolŋu appear not to believe the acquisition of abstract concepts to be fundamental, and it may be that assumption implicit in Balanda pedagogy, which proves to be the stumbling block for Yolŋu students and their Yolŋu teachers.

5. Conclusions

Maths as an Aboriginal community practice (whether it be Yolŋu maths or the use of western numbers and technologies) must be done with respect. This involves responsibility to kin, and to the environment. Continuing the distinction between Balanda maths and Yolŋu maths (and the search for the right words in Yolŋu languages) may be counter-productive. Going on together in the Yolŋu world already involves a daily integration of Balanda and Yolŋu maths. It is the pedagogy which produces the split between the two systems.

Western mathematics education theory (unlike literacy education theory for example) focuses upon the development of abstract concepts in students' minds. This practice may be acceptable in balanda classrooms, but in communities where Balanda number has an emerging and often contested role, its embodiment in community practice is completely lost or marginalised in the classroom if our teaching aims at producing a progression from concrete to abstract. Yolŋu teaches lose their confidence, students become alienated.

Foregrounding the abstract conceptual understanding of balanda maths in the classroom also allows and encourages question/answer routines and the split between testing and teaching which Yolŋu teachers and their students avoid (for what amount to ethical reasons). We have no reason to assume that these practices are essential to good maths pedagogy, and it seems they are quite foreign to what could be called Yolŋu pedagogy. Can we do without them?

If we avoid the focus on concepts in our pedagogy we can find ways to respect and benefit from the abilities of Yolŋu teachers without insisting that they learn Balanda pedagogical practices. These material classroom practices would begin with the repetitive rhythmic gestures of sorting, tallying, counting, figuring with objects like straws, and continue with developing quick, automatic ways with numbers through some of those rather ritualised processes with which many of us grew up, but which may have been abandoned in more recent years of classroom teaching. At the same time, we need also to seek always to locate our Balanda maths pedagogy in exploring and practising those aspects of contemporary Yolŋu life which are already ordered through balanda maths.

As we listen to Yolŋu experts talking about maths as a community practice we come to see how the mentalist shortcuts which we Balanda teachers take when teaching Balanda students speaking European languages in Balanda classrooms in Balanda communities, are in fact difficult and alienating 'longcuts' the work of building community capital for sustainable numeracy education in very remote Aboriginal communities.