

Does Mathematics Education in Australia Devalue Indigenous Culture? Indigenous Perspectives and non-Indigenous Reflections

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Chris and Leesa are two Indigenous people who have come to mathematics education through their involvement in the struggle for Indigenous rights; Chris from being an Indigenous researcher with a PhD in Applied Mathematics and Leesa from a degree in Commerce and experience publishing material on Indigenous culture. *Tom and Annette are two non-Indigenous people who have come to Indigenous culture through working in schools in Indigenous communities; both are mathematics educators and researchers.* This paper attempts to describe the profound effect of Chris and Leesa's perspectives that mathematics education devalues Indigenous culture (see Matthews, 2003) on Tom and Annette's Indigenous mathematics-education projects at QUT. It indicates the potential of partnerships to empower Indigenous research.

Note: The paper is written in heteroglossic form: Chris and Leesa's Indigenous perspectives are written in normal font; Tom and Annette's reactions and reflections are written in italics.

Two fundamental problems exist within mathematics education: Indigenous students find little relevance within mathematics, and educators have little faith in Indigenous students' mathematics abilities. Within Australia, mathematics education does not include Indigenous people and their cultures in its pedagogical approaches and, furthermore, it actually devalues Indigenous people and their cultures as too primitive to contribute to today's society (Matthews, 2003). *Tom and Annette's first mathematics-education projects in remote Indigenous communities involved working with teachers to enhance students' learning outcomes. These projects had little measurable effects on outcomes because of the inexperience, lack of cultural preparation and continuous turnover of teachers.* This paper provides an Indigenous perspective of Indigenous mathematics performance with some reflections of non-Indigenous mathematics educators, and looks at how these perspectives offer positive opportunities for the future.

Marginalisation and Exploitation

Indigenous students in Australia continue to be the most disadvantaged group in education (Frigo, 1999; Howard, 1998; Matthews, Howard & Perry, 2003). According to a state wide survey conducted by Queensland Studies Authority (QSA), Indigenous students in primary school are generally two years behind in their understanding of numeracy compared with non-Indigenous students (QSA, 2003). In general, the poor academic performance of Indigenous students tends to be attributed to high rates of absenteeism (Bourke, Rigby & Burdon, 2000), which can be linked to societal problems and the student's cultural responsibility. This approach puts the blame for poor academic performance onto the students and the community (Sarra, 2003) and takes the focus off the education system; systemic issues are rarely discussed or recognised within the literature as a contributor to the poor educational outcomes of Indigenous students (Bourke et al., 2000). *Understanding this and realising the system-wide*

inequities is one thing but working in the schools at this point in time where Indigenous students are failing and losing life chances is another. It seems that it is important to act now to assist individual students improve their mathematics performance. However, is this action making us part of the problem instead of part of the solution?

The education system, as a reflection of the dominant society's views (Jones, Kershaw & Sparrow, 1996; Matthews et al, 2003), has devalued Indigenous cultures as a primitive, simplistic society. This is further reinforced by the notion of 'technological progress', which has limited Indigenous peoples' ability to participate in scientific endeavours and allowed the continual exploration of Indigenous knowledge for scientific purposes. An education based on these principles, only serves to marginalise Indigenous people and undermine the significance of their Indigenous identity. In fact, Indigenous people still perceive education as an assimilation process where they must become 'white' to succeed and, consequently, challenges their Indigenous identity (Howard, 1998; Pearce, 2001). For the wider Australian community, this type of education develops a society that has no real understanding, and hence appreciation, of the Indigenous cultures in the land they occupy, making them susceptible to stereotypical views: it develops a societal ignorance. In short, there is no Indigenous context in the current education system. *Although it is suspected that devaluation is happening, it takes words like "primitive" and "simplistic" to bring the realisation that many white teachers (and educators and researchers) may stereotype Indigenous students as mathematically incapable. This can lead to a chauvinistic, almost missionary, zeal to bring mathematics (the "glory of Western culture") to Indigenous people (so they can "experience its wonder"); or to a "dumbing down" of the mathematics curriculum (through repetitious rote teaching of rules). It is common to hear, as a rationale for this zeal, the words "they need to know mathematics" and this position is often supported by Elders of Indigenous communities (because they wish their people to have more life chances and employment opportunities). However, it is likely that a stereotypical belief in the primitiveness of Indigenous culture is the driving force behind the actions of mathematics teachers, educators and researchers who work in Indigenous communities.*

Given that education is a reflection of the dominant beliefs of society (Matthews et al, 2003), the education system is geared towards devaluing Indigenous culture and its people. An education system based these ideals has two main effects. Firstly, it creates a societal ignorance where there is no in-depth understanding of Indigenous cultures and any understanding is usually fed by stereotypes. Secondly, the education system does not provide Indigenous students with any positive images of Indigenous people and their culture. This only serves to devalue their indigenous identity and isolate them further from mainstream society. As a result, within education, Indigenous people are not empowered and have no voice (Sarra, 2003). Societal ignorance is created hindering people's ability to relate to, and develop an understanding of Indigenous cultures. This further serves to isolate Indigenous People from the Western system limiting their opportunity to participate in their own culture and the decision-making processes of the mainstream society (Smith, 1999). Inevitably, Indigenous people become powerless, which leads to social problems such as alcoholism, physical and mental abuse. Furthermore, societal ignorance leads to the development of stereotypes, based on such social problems, which compounds the situation by, once again, devaluing Indigenous culture and the identity of Indigenous people. As a consequence, the circle is closed and Indigenous students continue to be the most educationally disadvantaged group within Australia particularly with regard to mathematics. *Three ideas emerge from reflecting on these ideas. The first is that there is a role for non-Indigenous people in developing understanding of Indigenous culture amongst non-Indigenous people. This leads, as will be seen later in the*

paper, to the idea that activity should work both ways and emphasise sharing of knowledge from both cultures to the other. The second idea is the relative ineffectiveness and downright oppression in Indigenous schools of the Ideology of Social Mobility, the major rationale for schooling, that any student can have any role in our society if they just achieve in school (with its implication that not achieving is a personal not system failure). As Willis (1978) has so effectively shown in the English situation, this ideology is nonsense for most students in disadvantaged areas and understood as such by most of these students. However, as Willis also showed, resisting this Ideology can lead to acceptance of a worse Ideology, that of the Separation of Labour and Management, that society must operate with a small number of people making decisions and the remainder following orders (and that those who fail will be the followers). The third idea is how to break the cycle - understanding is the start but change is the outcome desired.

Ignorance and Mistrust

Education reinforces the dominant beliefs of society and is never neutral (Matthews et al, 2003). As a result, mathematics education cannot be discussed without considering the whole context of Indigenous people particularly in relation to their history and experience with education. Many Indigenous peoples around the world have been confronted with the incursion of Western Society on their traditional way of life. This incursion inevitably creates a divide between the two cultures with the Indigenous cultures becoming subservient to the dominant Western system (Kawagley, 1995) with little regard being paid to the importance of the Indigenous cultures. *It is too easy to focus on Indigenous Australians as a unique group and not to realise that they reflect a common disadvantage that occurs in many countries. There are also strong Indigenous movements in other countries that can provide illumination for the Australian situation. The international situation also provides evidence that Indigenous disadvantage is not the particular problem of the Australian Indigenous people, but a problem of the globalised structures and systems under which most countries operate.*

Societal ignorance of Indigenous culture and concerns are propagated through the media and education system of the mainstream society. Historically within the Australian context, the education system has been used to propagate notions such as *terra nullius* and assimilation through the history and social science curriculum. Chris' found his school experiences confusing; he was taught that Captain Cook discovered Australia and that other explorers then discovered various other parts and wondered where were all the Indigenous people? This systemic denial continued through his school years and, at best, the education system portrayed Indigenous people as the primitive but a "noble savage". Usually, the nobility was afforded to Indigenous people from the amazement of the Western world that Indigenous people 'survived' (not lived) within the extreme conditions of the Australian landscape: an underhanded recognition of their ingenuity. To compound the situation, the science and mathematics curriculum enforced the notion of "technological progress". The underlying messages in this notion is that society is evolving linearly into a more advanced technological society and other cultures, that have not developed the same type of technologies, are considered primitive, simplistic and less advanced. Consequently, the belief of technological advancement has not allowed a place for Indigenous people, and their cultures, within education and, in particular, science and mathematics education. This position is still being argued in relation to the inclusion of ethnomathematics in the mathematics curriculum (e.g., Rowlands & Carson, 2003). Furthermore, there is little recognition of the scientific achievements of Indigenous Australians even though Indigenous knowledges have been exploited for Western scientific purposes. *The notion of "technological progress" as a*

measure of advancement is interesting for mathematics. From one perspective, it could be argued that the invention of number is a consequence of being in a society where individual ownership of objects and land is important. Without the need to determine how many sheep are owned or where the land ends, there is no requirement for number and measurement as has been developed by Western Society. Hence, there are strong arguments for considering Western mathematics as a consequence of Western Culture (e.g., Walkerdine, 1992; Wilder, 1981). Thus consideration of Indigenous cultural contexts for mathematics (e.g., kinship relationships) requires a rethink of mathematics and what is important in it. It may be that their culture will enable mathematical understanding to be a strength of Indigenous students if the mathematics is taught holistically through pattern and structure (rather than through sequential teaching of number and algorithm). This position has become the basis of Tom's and Annette's latest research proposals.

The superior positioning of the Western world and the continuing exploitation from this ideology has resulted in a relationship of mistrust between Indigenous peoples and research institutions. Indigenous peoples are considered to be the most researched groups of people in the world (Mack & Gower, 2001) and have rarely seen any benefit from research. Two examples are given in Matthews (2003): the first relating to the treatment of David Unaipon Australia's first Aboriginal author and inventor whose ideas were stolen from him (Shoemaker, 1989) and the second relating to Indigenous medicines (Nolan, 2000) which prejudged Indigenous culture and knowledge as primitive, simplistic and without the capacity to understand "why". In both these cases, Western science used Indigenous knowledge to advance their knowledge with very little recognition of Indigenous intellectual property rights or that the Indigenous knowledge system has modern relevance. According to Smith (1999), research has "a history that still offends the deepest sense of our [indigenous peoples] humanity." Consequently, Indigenous people consider researchers to be a pack of self-centred "bastards" who are only interested in extracting information from their community, declaring ownership of the information and using it for their own advancement (Foley, 2000; Mack & Gower, 2001). To Indigenous people, research is another form of colonialism and dispossession where their community and culture is not valued by the researcher (Foley, 2000). To overturn this situation, Indigenous researchers are currently developing Indigenous research methodologies that incorporate culturally sensitive research techniques. These methodologies are centred on self-determination, empowerment, ownership of knowledge and, in general, respect for culture, community and individuals (Foley, 2000; Mack & Gower, 2001; Smith, 1999). *The role of research in the oppression of Indigenous peoples was an eye opener to Tom and Annette as they had seen their own research as way of improving Indigenous situations. They now came to question their own research methods and motivations, particularly any underlying stereotypical assumptions. The anger of Indigenous people towards researchers can be understood from even a cursory glance at history and present day research. The empowering outcomes approach to decolonising methodologies, as described in Smith (1999), has become the methodology adopted in Tom and Annette's latest research proposals. This methodology allows researchers to engage with Indigenous communities on research projects in collaboration with the communities as equal partners.*

Contextualisation

The 'contextualisation' of mathematics is a relatively new strategy aimed at bringing relevance into mathematics education for Indigenous students (Howard, 1998; Jones et al, 1996; NSW Board of Studies, 2000). Fundamentally, it involves incorporating aspects of Indigenous culture and Indigenous perspectives into the pedagogical approaches to

mathematics education in order to instil a strong sense of pride in the students' indigenous identity and culture (Cronin, Sarra & Yelland, 2002; Day, 1994; Sarra, 2003) Essentially, the contextualisation process attempts to develop links between the two knowledge systems that on the surface seem light years apart *Contextualisation was interesting for Tom and Annette in that it could be considered as a practice that has long been advocated; that mathematics ideas are taught from contexts/situations from the everyday world of learners However, it has a second component; it requires that the contexts be ones that enhance Indigenous pride and reinforce self belief*

The majority of educational research involved in improving mathematics education for Indigenous students has occurred in remote communities (Frigo, 1999; Harris, 1991; Harris, 1984) These communities, and the people within the communities, are generally referred to by researchers as "traditionally oriented" where Western society has had a minimal impact on their way of life (Harris, 1991; Harris, 1984; Jones et al, 1996) They have retained their languages, kinship system, ceremonies and, in general, their 'ways of knowing' Generally, researchers have focused on these communities, taking an anthropological approach, to investigate cultural differences In particular, they attempted to document differences in teaching methods, ways of learning and in ways of perceiving certain mathematical concepts such as space, measurement, number and problem solving (e g , Frigo, 1999; Harris, 1984) There is a danger that these comparisons have come from researchers who perceive Indigenous cultures as simplistic "hunter gather" societies, and who may have underestimated the cultures they were studying On the other hand, this type of research highlighted a seemingly vast difference between the Western and Indigenous worldviews, which need to be reconciled if education was to succeed without jeopardising the children's Indigenous identity and culture (Jones et al, 1996) *Culture has been a difficulty for Tom and Annette because they work in urban situations, in communities made up of many tribal groups, and in "traditional" communities, all of which have different and changing cultures, heritages and knowledge of their past It has led to: (1) considering all literature with suspicion in terms of the Indigenous people it purports to examine or the biases and stereotypes of its author(s); (2) doubt with regard to own assumptions and biases; and (3) more reliance on collaboration with the communities*

To date, one of the best examples of reconciling these differences is *Garma* mathematics, which is being used in the Yolngu people's Community School at Yirrkala *Garma* is referred to as a "both-ways" education where Western mathematics and Yolngu mathematics are presented alongside each other (Jones et al, 1996) This allowed for the complexity of the Indigenous worldview to be used directly in the expression of Western mathematical notions For example, Yolngu children, from a young age, have a good understanding of their kinship system, which governs the Yolngu way of life This system is very complex and relies on cyclical, recursive patterns Such patterns can be found within numbers themselves and other areas of mathematics (Jones et al, 1996; Divola & Wells, 1991) and forms a good basis for Yolngu children to start their journey into Western mathematics An education based on *Garma* has empowered the Indigenous communities and its people in and around Yirrkala They, in equal partnership with non-Indigenous teachers and the Western school system, determine how their children are taught Education now reinforces their culture, provides relevance for the students and gives the students a sense of pride within themselves and their culture (Divola & Wells, 1991) *It is important that interactions go both ways; that learning is led by Indigenous as well as non-Indigenous and that mathematics comes from Indigenous community contexts as well as contexts outside the community However, it is important not to get caught up in applying reductionism to find mathematics relevance within Indigenous*

culture as this approach may lead to Western pedagogies dressed up in superficial Indigenous motifs

The majority of Indigenous people within Australia live in rural or urban settings (Matthews et al, 2003) Within these communities, instilling a strong sense of pride in the students' Indigenous identity and culture is also a key element in a successful education This is the basis of the approach taken by Chris Sarra at Cherbourg State Primary School In 1998, Sarra was the first Indigenous principal to be appointed at Cherbourg Primary State School and, on his appointment, found a school that was in total disarray with poor academic standards (80% achieving below state standards) and disempowered Indigenous teachers and teacher aides To compound the situation, the non-Indigenous teachers accepted the students' poor performance and behaviour as a "social and cultural legacy" or "an Aboriginal thing" (Sarra, 2003) and valued their teaching performance given the difficult circumstances To overturn this situation, Sarra consolidated a school vision to reinforce pride in Indigenous identity and culture, to associate Aboriginality with intelligence, to have high expectations and challenge students His strategies showed a 94% improvement in attendance rates and halved the number of students performing below the state standard *There are two points here First, teachers can both enable and oppress; and non-Indigenous teachers who do not believe Indigenous students can learn cannot remain as teachers of Indigenous students Second, the structures within Indigenous schools must change to empower Indigenous teachers, teacher aides, and community members This will make the schools part of their communities rather than a separate (oppressive) entities*

The contextualisation of mathematics education has been recognised as an important strategy to improve educational outcomes for Indigenous students in mathematics It has worked for Yirrkala Community School and Cherbourg State School It has become a major study in New South Wales (Howard, et al, 2003; NSW Board of Studies, 2000) However, given that Indigenous culture and people have not been represented positively within the education system, the contextualisation of mathematics education could be problematic First, some non-indigenous teachers will not be familiar with the new educational context and will find it difficult to relate to the new context (Connelly, 2002; Howard, 1998) Five non-Indigenous teachers left Cherbourg State School because they did not believe in the changes being made at the school, particularly in relation to a challenging education based on believing in the students' abilities and providing a relevant educational context for the students Second, their difficulty with contextualisation may cause some non-Indigenous teachers to reject the notion and resort to familiar pedagogical approaches This may be reinforced by the perception that Indigenous culture has no place in mathematics, a view held by ethnomathematics' critics (e g , Rowlands & Carson, 2002) Third, Indigenous people may perceive that their culture is not relevant to Western mathematics and/or that aspects of Indigenous culture cannot be taught through the Western education system *Research projects with teachers and teacher aides have shown that many non-Indigenous teachers do not believe it is necessary to contextualise (or to give more authority to or form teaching partnerships with Indigenous teacher aides) The continual turnover of non-Indigenous teachers in communities has redirected Tom and Annette's research towards supporting and collaborating with the Indigenous teacher aides and other interested community members in developing capacity to enhance students' mathematics learning outcomes*

Summary and Implications

The length of this paper precludes extensive discussion of the perspectives/reflections, but three points can be made First, the contextualisation process is not a straightforward

curriculum issue *It requires changes in power relations within schools and changes in deeply and tacitly held stereotypical assumptions* However, it has the potential to change the educational environment so that Indigenous cultures and their way of knowing are valued rather than devalued and that Indigenous students have pride in their culture and believe that they can perform well in the education system It can also reinforce, to Indigenous students, that Indigenous knowledge has contributed to scientific knowledge demonstrating its sophistication and relevance for modern times Furthermore, it provides an opportunity for non-Indigenous students to gain some insight into Indigenous culture, which will alleviate the problem of societal ignorance Second, contextualisation needs to be studied in a variety of Indigenous life experiences to determine the answers to Watego (submitted) question: “What is contextualisation?” *Watego argues that shopping lists and spreadsheets have become part of Indigenous peoples lives, particularly when dealing with the Western system* Third, collaboration between Indigenous and non-Indigenous researchers provides powerful insights to non-Indigenous researchers and is one way forward to harness the power of research for Indigenous emancipation and empowerment *However, the non-Indigenous researchers have to be willing to examine their own beliefs*

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