

DISCURSIVE PRACTICES AS CULTURAL CARGO

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This article focuses on images of mathematics education in the South Pacific. The view of mathematics education as an imported good to islands in the South Pacific is nicely captured by Yerua (1982) who noted, in a paper considering how Papua New Guinea might improve the mathematics achievement of its students by developing a local series of textbooks, “Experts from developed countries tell us that textbooks do assist pupil learning” (p. 233). Difficulties arising from the introduction of non-indigenous mathematics and mathematics teaching dominated by exposition and textbook delivery are also expressed by Yerua, who observed that the use of textbooks in Papua New Guinea was problematic because of the difficulty of the English language used, of the availability of materials prescribed in the texts, and “other numerous reasons” (p. 232).

These statements speak compellingly of tensions in the development of mathematics education across the Pacific – of what some have viewed as part of the cultural “cargo” (e.g., Swadridge, 1985) of experts bearing superior skills, wisdom, and resources. The prevailing binary classification, which constructs some nations as *developed* and others as *developing*, assumes benefits for introduced beliefs from developed countries about how children learn and about effective pedagogies of mathematics.

Yerua’s reflections identify many of the challenges facing mathematics educators in small South Pacific island nations today. His recognition of tensions between indigenous knowledge and epistemologies and those of experts from abroad have been echoed by more recent writers such as Gegeo and Watson-Gegeo (2001, 2002), Subramani [1] and Huffer and Qalo (2004). These writers describe from the ‘inside’ how indigenous groups of the South Pacific are

asserting the validity of their own ways of knowing and being, in resistance to the intensifying hegemony of mainstream epistemology from the metropolitan powers. (Gegeo and Gegeo-Watson, 2001, p. 55)

Using photographic images of children and classrooms from countries of the South Pacific, I reflect on mathematics education in this region as cultural landscapes in transition, in which imported discursive practices of mathematics education have acted as instruments of change. Cotton and Hardy’s (2004) redefined understanding of Foucault’s definition of discursive practices as

anything written or said or communicated using signs, including actions in the classroom, resources used, and arrangements of the furniture (p. 88)

is useful in thinking about how photographic images might reveal ways in which mathematics is culturally embedded and socially constructed by means of such discursive practices.

I use the idea of discursive practices as both *constructions* of, and *constructive* of socially negotiated realities, to examine images of childhood, educating, and “mathematics” within small Pacific Island countries. For children, mathematics is constructed through the everyday practices of classroom mathematics programmes. The ways in which mathematics is learned, how mathematics is presented, how the children and teachers are positioned within the mathematics learning experience, and how mathematics is assessed are all critical elements of the processes of construction.

The tensions, conflicts, pitfalls and ethical quandaries inherent in this kind of ethnographic research, where ‘outsiders’ attempt to look ‘in’, are thoroughly investigated by Madison (2005) who demonstrates how critical ethnography is complex and conflicted. Harrison has grappled with these dilemmas in his ethnographic studies of indigenous Australian students’ experiences of tertiary education. He contemplates how we might develop ethnographic research “to ensure the voices of each and all are represented” and concludes:

This does not mean incorporating other positions into our own nor defending it against the criticism of others. This would perpetuate the power relations that give a voice to some and not to others. Rather we could look for an inclusive interpretation [...] which allows all the different voices to speak, rather than one that is produced as the best or most plausible alternative (2003, p. 105)

This photographic study, then, may be regarded as one voice in a story that can be told in many ways. My interpretations of the photographic images are fashioned by my experiences as a primary classroom teacher, primary mathematics adviser to schools, tertiary teacher of mathematics education, and ethnographic researcher in primary mathematics education in New Zealand, Australia and a number of countries of the South Pacific. My experiences as the partner of a social adviser who has worked with communities, Non-Governmental Organisations (NGOs) and governments throughout the Pacific for the past twenty years, as a resident of Fiji and Vanuatu for extended periods, and as a traveller around the South Pacific, also contribute to my selection and reading of these photographs. In these capacities, I have visited a wide range of classrooms and conversed with many teachers, parents and children in the South Pacific region.

The photographs speak to me of global approaches to mathematics education and in turn of children’s culturally-

embedded ways of being. For me, they raise questions about the political and epistemological drivers of these global approaches, and the political and ontological implications of a globalized mathematics curriculum. This article is intended as a contributing voice to an important story, and appreciates that the photographs can, and indeed should, be read in many other ways by those who are also part of this story.

School mathematics, whose mathematics?

In the ethnomathematical view, the ways in which *mathematics* is culturally constructed are inseparable from, and indeed significantly determine, the means by which mathematical skills and knowledges are passed on to new generations of learners. The islands of the South Pacific provide important insights into how this process has been renegotiated with the advent of Western colonization. Rich pre-existing mathematical curricula have been superimposed with introduced and often conflicting mathematical ways of knowing, being, doing, teaching, and learning. There are highly developed life wisdoms to be found in the Pacific such as anatomy-based counting systems, oral methods of recording relationships and genealogies, accurate navigation across vast stretches of ocean and locating and managing fishing grounds, diverse forms of human expression from spatial and rhythmic patterns of song and dance to the geometrical configurations of string games and technical expertise requiring sophisticated spatial skills such as basket-weaving and net-making.

Education is perceived by developed countries as being one of the critical elements of development for the least developed countries (LDCs) [2]. For many decades, developed countries have been assisting “education” in LDCs. This is no less true in the Pacific where, with the close relationship many countries have developed with Australia and New Zealand, curricula, teaching resources especially textbooks, school buildings, school management and assessment strategies have been directly modelled on Australia and New Zealand schools. Both Australia and New Zealand give high priority to delivering educational assistance through their aid programmes. Through various partnership arrangements between these donor countries and South Pacific recipient countries, education delivery and practice is changing

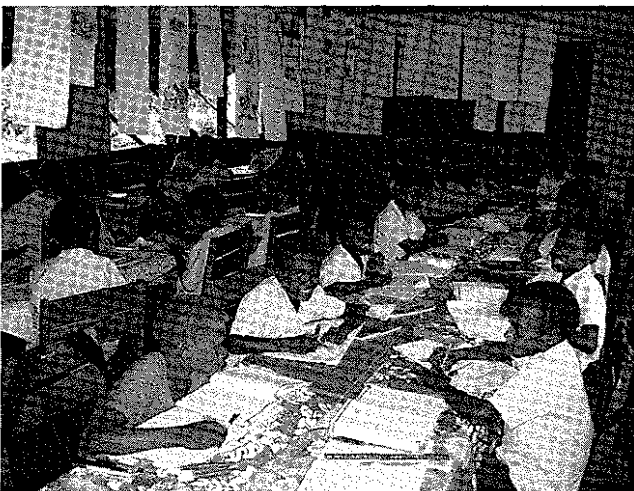


Figure 1: Classroom in action – Tanna, Vanuatu

Figure 1 shows children engaged in a mathematics lesson in a classroom on a remote island in the Vanuatu group. In this classroom, the children are engaged in the same model of learning as can be found throughout the Western world. Here, their learning of mathematics is structured into *lessons*, managed through discrete teacher-selected *tasks* and performed individually as *work* consisting of providing *answers*. The learning is grounded in symbolic written communication, prescribed by textbooks in English, monitored and regulated by disembodied experts from the outside speaking through the text. It is a mode of learning that has been described by Doyle (1988) as a process in which

[t]eachers affect tasks, and thus students’ learning, by defining and structuring the work students do, that is, by setting specifications for products and explaining the processes that can be used to accomplish work. (p. 169)

The children do not see their village world reflected in either the mathematical knowledge or skills being taught, or the processes of learning.

Teachers and researchers from the South Pacific such as Bakalevu (1997), Latu (2005) and Matang (2005) have described uniquely ‘Pacific’ views of the *child*, cultural ways of transgenerational transfer of knowledge and skills and powerful cultural mathematising of South Pacific Island communities that pre-existed the importation of Eurocentric mathematics. This mathematising is embedded in everyday life and woven into a world-view that differs substantially from that of the colonisers. These researchers offer more than interesting anthropological insights; they serve to bring to light and challenge the epistemic, ontological, and socially constructed foundations of the body of knowledge and skills that has come to be known as *mathematics* and of Western approaches to educating.

I gained my first experience of mathematics education in the Pacific when I visited a remote Year 6 (ten- and eleven-year-old children) village classroom in Fiji in 1999. The children were engaged in a mathematics lesson involving addition, subtraction, multiplication and division with common fractions. The teacher had copied 72 practice examples from an old Australian textbook onto the blackboard, covering its entire surface. Seated in rows, the children were silently completing the examples in their books.

This experience typified primary school lessons I observed in my subsequent travels around small island nations of the South Pacific, where the prescribed mathematics curriculum was invariably found to be derived from non-indigenous sources, either directly using imported teaching materials, or indirectly using materials that were adapted for local use by the inclusion of relevant contexts such as the teachers’ guides produced by the Curriculum Development Unit in Fiji (Ministry of Education and Technology, 1998). The mathematics curriculum I observed was implemented through textbook-oriented pedagogies and assessed by written tests and examinations. Success in school mathematics examinations was widely regarded by Pacific Island parents and teachers as the gateway to children’s overall success in education and a key determinant of future employment.

The pedagogical tradition of teachers structuring mathematical learning through a series of carefully selected and closely managed discrete *tasks*, and the significance of *task* in mathematics educational discourse, may be regarded as an entrenched cultural feature of the Western mathematics classroom. Pedagogies of Western mathematics have been particularly regulated by a prevailing epistemological view of mathematics as a discipline consisting of a body of specialised procedures based upon unassailable universal principles, which are seen as forming a logical learning progression hierarchically arranged according to increasing complexity. In this view, mathematical truths can best be conveyed to learners through a process of initiation in which the learner is assigned increasingly difficult tasks by teachers who have, through a similar process, acquired the same knowledge and skills.

Informal mathematizing: making meaning

Many writers in the ethnomathematical field have looked to well-defined cultural practices that are recognizably *mathematical* in order to argue that mathematics is a universal human endeavour, locally and culturally inscribed. In the Pacific, techniques such as numbering systems of Papua New Guinea, patterned basketry, or navigation have been studied in this way. The informal mathematizing of children in non-Westernised countries has attracted less attention, however. In Bishop's (1991) list of what we might regard as doing mathematics, he suggests that *playing* be included as an essentially mathematical pursuit.

Figure 2 provides a vision of mathematical playing. In a small remote village in Vanuatu, five-year-old Fellyn was seen deeply absorbed in an activity of her own design. Using a collection of objects including shells, seeds, stones and a pencil stub, which she had gathered in a plastic bag, Fellyn was selecting and placing the items to create an elaborate spatial formation. Although I wondered at the reasoning behind her invention, I recognised Fellyn's activity as essentially mathematical since it involved recognition of attributes, comparing, sorting, grouping, connecting, patterning, aligning, shaping, and covering space. Through her

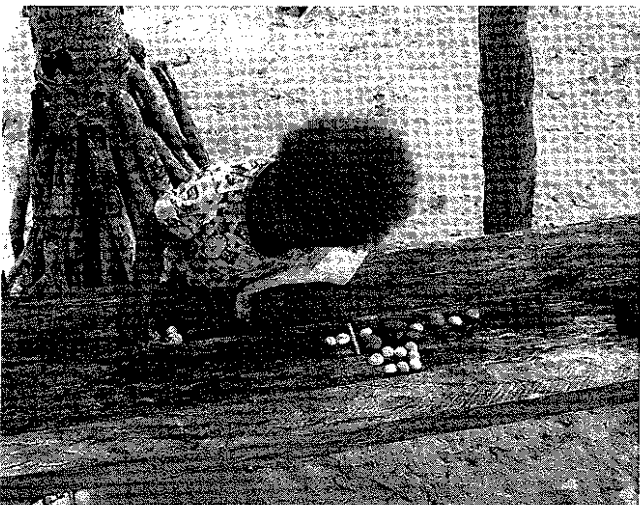


Figure 2: Fellyn arranging objects on a village beach, Pele, Vanuatu

playful and creative use of local materials, Fellyn could be seen to be profoundly engaged, her thinking embodied in the both the logic and aesthetics of this physical act of arranging. Davis (1996) describes similar mathematizing in his young niece's sophisticated arrangement of her collection of toy horses. He tells of how she has already become fearful of school mathematics, and reflects upon how school mathematics fails to intersect with children's existing mathematical thinking.

A growing body of researchers are now focusing on the home/school gap, to explain children's failure to thrive in the learning of mathematics at school. Worthington and Caruthers (2003), for example, have explored children's invented mathematical representations as a rich source of understanding about children's ways of mathematical thinking, suggesting that teaching methods must take account of such thinking. The schism between school and non-school mathematics has been amplified in small Pacific Island settings, since school mathematics not only fails to connect with the world of the child, but also fails to connect with the geographical surrounds into which it has been introduced.

Making marks – mathematical meanings

When I met Joses on a village beach, I asked him about school. In response, he picked up a stick and began scratching in the sand. The marks he produced were the commonly used symbols for counting numbers (see Figure 3), laden with meaning for both of us. He continued creating these symbols until he reached 16, smoothing more sand when he ran out of space. He then recited the sequence in English, stopping at 20.

It is significant that for Joses, school, mathematics and the forward sequence of counting numbers in both written and spoken form, were linked. This incident hints at the teaching programme he has experienced in his classroom – the methods of learning, the subject matter, and what he perceives as valuable. He did not gather a group of objects and demonstrate to me his counting or calculating skills; instead, he wrote and recited. This suggests that he has experienced discursive practices of schooling in which sitting, listening,

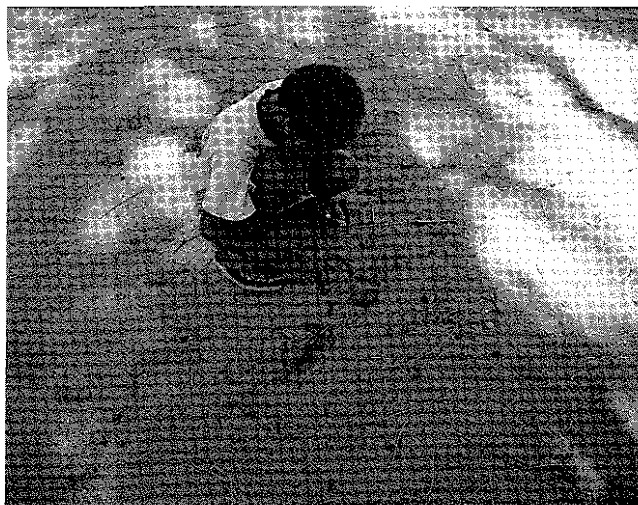


Figure 3: Joses writing numbers in the sand, Efate, Vanuatu

writing and reciting serve as primary pedagogical approaches in the transferral of mathematical knowledge and skills from teacher to learner. He has also learned to count in English, the primary language of commerce within the South Pacific.

Making meaningful marks in sand is common in the Pacific. Some island groups in Vanuatu, particularly those of Ambrym, have developed a vocabulary of sand drawings to create messages, a method of communicating that significantly predates the arrival of European colonisers bearing pens, slates and paper. Such messages are conveyed through intricate spatial symbols traced in sand with a finger or stick. These drawings are sophisticated, beautiful, and involve considerable mathematical thought to both invent and recreate since they are formed with a continuous line.

During my time in the Pacific, I have often witnessed adults using sticks in the sand or earth to draw maps, or to perform mathematical calculations. In Jose's everyday life, sand and stick continue to serve as accessible and sustainable media and tools for creating and recreating meaningful symbols. Jose had readily transferred skills acquired in school from classroom to beach. Although this photograph demonstrates Jose's translation of aspects of his learning of mathematics from classroom to the world outside, it might be asked how much of the world outside is carried into the classroom for him and other Pacific Island children.

All cultures communicate not only through the spoken word, but also through the making of meaningful marks and the creation of symbolic objects. If we are to consider how school mathematics might best serve the children of small Pacific islands, we must take account of mathematical mark-making as both culturally constructed and culturally defining. Where children cannot see or hear themselves in symbols of mathematical communication, where they identify school mathematics as derived from elsewhere, at best they will take on the knowledge for its perceived value through a mechanical process of practice and memorisation, and at worst, they will reject it since it fails to speak to, or about, them.

Discursive practices in translation

The following photographs (Figures 4 to 9) demonstrate how the discursive practices of mathematics education, found in developed countries, have been adopted by schools in the South Pacific.

Figure 4 shows Zilo writing numbers in his workbook. They are arranged horizontally in groups of tens, replicating the 100s chart now used widely in schools in the United Kingdom, Australia and New Zealand as a key teaching tool in numeracy enhancement strategies. The number strand of mathematics is becoming increasingly emphasised in developing countries, with the claim that numbers form the foundation of all mathematics. Accordingly, reforms in mathematics education in the Pacific have also been strongly influenced by such changes.

In an article printed in a newspaper (Vanuatu Daily Post, 2005), a young Japanese volunteer teacher who spent three years working in a small village school is quoted as saying:

When I first visited [the] primary school, I was surprised because a lot of the students didn't understand numbers, addition and subtraction. Many teachers did

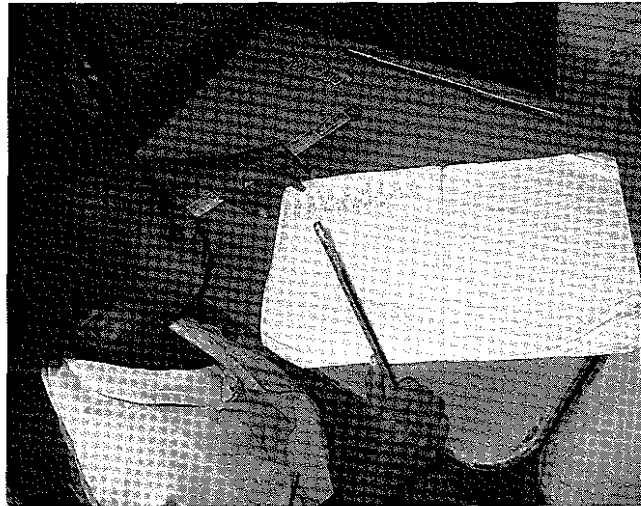


Figure 4: Zilo writing numbers in his schoolbook, Malekula, Vanuatu.

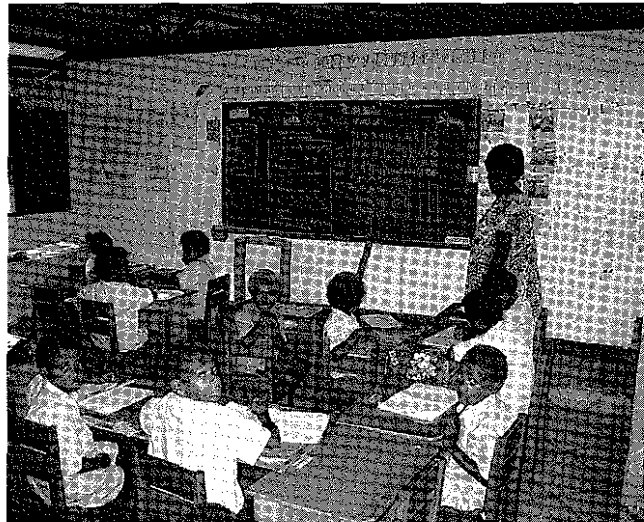


Figure 5: Blackboard pedagogy, Malekula, Vanuatu.

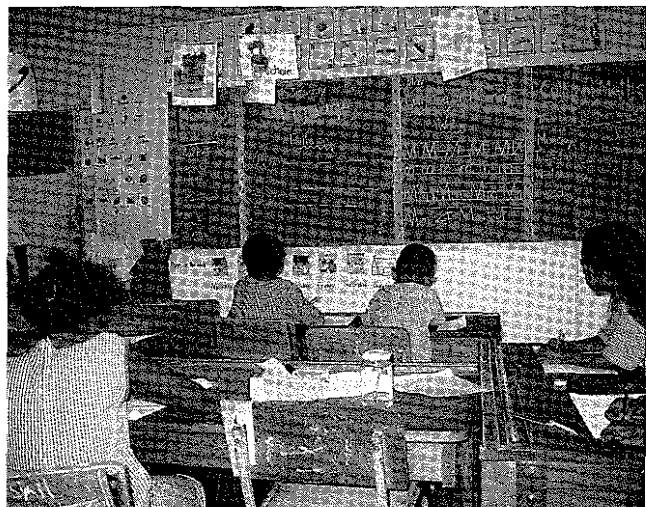


Figure 6: Blackboard pedagogy, Port Moresby, Papua New Guinea



Figure 7: Number line and mathematics equipment in a classroom, Lae, Papua New Guinea.

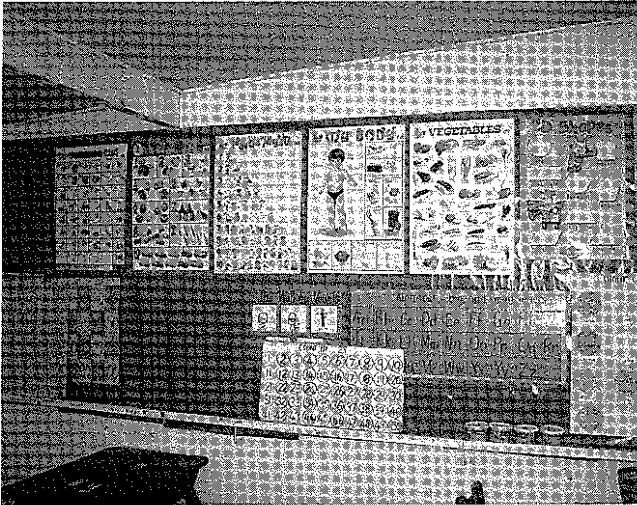


Figure 8: Mathematics posters and charts on the classroom wall, Lae, Papua New Guinea



Figure 9: Children grouping local materials in "tens", Tanna classroom, Vanuatu.

not understand the importance of a strong mathematical foundation and moved on to more advanced topics before their students understood the numbers.

In her statement, the volunteer presented a view of the Hindu-Arabic number system and the operations of addition and subtraction as the foundation of mathematics. In this view, she regarded the students and teachers of the village school as mathematically deficient. Once she had diagnosed their weakness (a lack of understanding of Western concepts of numeration, numbers and operations), she saw it as her role to repair the deficiency. Her culturally constructed beliefs and values about mathematics assume a mathematical universality that transcends locale, and denies a rich pre-existing and coexisting curriculum.

Figures 5 and 6 capture Western-derived discursive mathematics education practices of blackboard, textbook, and workbook faithfully reproduced in the Pacific. In addition, the influence of changing approaches in mathematics in developing countries can be seen: a 100s chart has been drawn on the blackboard in Figure 5, and in Figure 6, the heading *Cultural Math* and an exercise in patterning appear.

Figures 7 and 8 illustrate how imported symbols and the apparatus of mathematics have been adopted in classrooms in Papua New Guinea. In Figure 7, a group of boys are playing with blocks. Above them, a locally constructed number chart is displayed. These kinds of charts are common in classrooms in Australia and New Zealand, though often commercially produced.

Figure 8 shows a classroom display including mathematics posters supplied by donors, and locally made number pattern charts. The posters depicting vegetables and parts of the body powerfully remind us of how all such representations are culturally inscribed texts, and far from universal. These photographs reveal few signs of indigenous curricula, indigenous teaching and learning methods or of indigenous mathematics.

Innovations from abroad

Approaches to education in the Pacific are changing as concerns are expressed about levels of achievement, low enrolment rates in some countries even at primary school level and high dropout rates particularly for girls (e.g., Pacific Islands Forum Secretariat, 2001; Afamasaga, 2002). Forty percent of children across the Pacific region do not continue schooling beyond primary level. Accordingly, current initiatives in education in the region are now focused on *basic education*:

[i]mproving all aspects of the quality of education and ensuring excellence for all, so that recognised and measurable learning outcomes are achieved, especially in literacy, numeracy and essential life skills (Pacific Islands Forum Secretariat, 2001, p. 2)

as demonstrated by the Forum Pacific Islands Forum Secretariat (2001) in its education action plan in which they outline a Pacific vision for education stating that

Forum members recognised that development of basic education takes place in the context of commitments to the world community [] which should be balanced

with the enhancement of their own distinctive Pacific values, morals, social, political, economic and cultural heritages [...] (p. 2)

New waves of agents from 'the outside', including policy analysts, educational consultants, volunteers and missionaries, are contributing to change in mathematics education in the South Pacific. UNICEF, for example, has introduced the child-friendly schools initiative that has been developed in line with the United Nations Millennium Development Goals [3]. Figure 9 shows a classroom in a school in Vanuatu, which is currently trialing this approach. In this school, curriculum has been negotiated locally, local resources are used, and context and relevance are emphasised. The photograph shows an attractive classroom environment where the teacher has adopted an active investigative approach to exploring decimal structure. Each child has gathered one hundred like objects and then grouped them in tens. The children are seated in groups to encourage discussion. The discursive practices of this classroom contrast sharply with those of the blackboard and textbook classrooms, reflecting the influence of social constructivist approaches that have been adopted in developed countries

Another recent initiative is the establishment of PRIDE (Pacific Regional Initiatives for the Delivery of basic Education), a regional funding programme established to help countries implement the Pacific Islands Forum Secretariat's basic education action plan. Although

one of the core principles of the PRIDE project is a commitment to building the reform of education on a strong foundation of local cultures and epistemologies (Teasdale, 2005)

the reform process is still largely determined by consultants bearing cargo from outside. An example of the work funded through this organisation is the introduction of the New Basics educational approach developed in Queensland, Australia, to the small Pacific island state Nauru. Australian specialists have adapted its central discursive practices known as *rich tasks* and *productive pedagogies* to the Nauru setting. Difficulties in translating these practices from an Australian to a Pacific island setting are voiced by a Nauruan Year 4 (eight-year-old children) teacher who commented "the new reform needs parents' support and that getting them and their children involved would be a huge challenge" (PRIDE, 2005, p. 3).

Since missionary times, churches have also been significant providers of education in the Pacific. With a recent resurgence in the Pacific of a variety of fundamentalist churches emanating from developed countries of the Pacific Rim, some Pacific Island governments have allowed church groups unfettered access to build schools, supply teachers from the 'outside', and deliver their own forms of curriculum

Whose mathematics, whose pedagogies, and where to next?

The photographs present us with visions of discursive practices of Western mathematics education transplanted uneasily into tropical island settings. Educational debate and assistance in the region is structured from an 'aid' and

'development' perspective, foregrounding deficiencies and denying existing knowledges. Agencies involved in mathematics education in the region provide assistance from the 'outside' in ways that meet the development needs of modern monetised economies situated in a global context and based on trade and service imperatives. Tensions exist between these imperatives and the stated Forum Secretariat Education Action Plan vision of retention and enhancement of uniquely Pacific world-views.

The difficulties created by discursive practices of mathematics education exported as commodities by developed countries have been raised by writers such as Bradford and Brown (2005) whose research reveals how local interpretation and sense-making collide with a presumed universality of meaning embodied in the language of mathematics imported from elsewhere. Anderson (1997) questions to what extent these imports acknowledge the efficacy of local and indigenous knowledges in general, and mathematical knowledges in particular. He reflects on alternatives such as a "worldmath" curriculum. Such a view is supported by Giraure (1976) who describes how Western schooling in a mission school in Papua New Guinea transformed him from Tolai village child to Europeanised teacher reproducing the Western curriculum he had received. In reflecting on the lack of balance in his education, Giraure suggests that

a new curriculum might be more useful - one which contained not only the knowledge of overseas people, but also the knowledge of the people of Papua New Guinea [...] [i]t would certainly give both parents and children a better chance of making the best possible use of education - but a new education - an education for their needs. (p. 66)

Atweh (2004) has suggested that international mathematics education research might be viewed in terms of the relationships between partners. He considers four models of interaction, *aid*, *development*, *multiculturalism* and *critical collaboration*, suggesting that *recognition* is a key element of positive and empowering partnerships. Most partnerships in the development of mathematics education in the Pacific have failed to fully recognise and embrace indigenous mathematizing, indigenous teaching and learning modes, and the mathematical strengths of Pacific Island children.

The notion of locally negotiated curriculum as an emerging response to tensions created by education as cultural cargo is explored in the model described by Hedegaard and Chaiklin (2005) who have developed what they term a *radical-local* teaching and learning approach which focuses on "how education can contribute to the personal development of children in relation to their historical and cultural conditions" (p. 11). A similar approach is suggested by Teasdale (2005), who conceives of Pacific curricula created by a process of *dynamic syncretism*, that is, a locally generated fusion of "tradition and modernity, the spiritual and the temporal, the global and the local" (p. 3). He reflects that

it is becoming increasingly recognised in the Pacific that [young people] need to grow up with a clear sense of their own cultural identity, built on a strong foundation of their own cultures, languages, and spiritualities, with

a deep pride in their own values, traditions and wisdoms. (p 3)

This is echoed by Puamau (2005) who says,

[a] groundswell of opinion on the critical importance of rethinking education in the Pacific is rising from Pacific nations and their educators. They recognise that their education systems are still caught up in a colonised time warp despite the fact that most Pacific nations have been politically independent for some decades. The issues of control and ownership of the processes and structures of education are particularly important to them. (p 1)

Negotiating relevant, meaningful and empowering discursive practices in mathematics education in the South Pacific presents a new and pressing challenge. If children and communities of the region are fully to benefit from education in the 21st century, new models of mathematics education for the Pacific must be developed that go beyond an uncritical adoption of the discursive practices of Western mathematics education.

Acknowledgements

I wish to thank the children who appear in these photographs. All subjects most willingly gave their permission to be photographed. I explained to each child how the photographs were to be used, but I am not sure I was always fully understood. To protect the children's identities, the names I have used are fictitious. Their appearance in this work makes a welcome contribution to our understanding of the children and of their mathematical education in this special region of the world.

Notes

- [1] Subramani, M. (2003) 'Emerging epistemologies', paper presented at the conference for South Pacific Literatures, Noumea, New Caledonia
- [2] LDCs is the acronym for *least developed countries* used by bilateral and multilateral development agencies to describe the group of "poorest" countries in the world as measured by *per capita* income. In the Pacific, there are five LDCs: Vanuatu, Solomon Islands, Kiribati, Tuvalu and Samoa
- [3] The UN Millennium Development Goals, part of the UN Millennium Declaration, were developed by world leaders at the United Nations Millennium Summit in 2000. They form the core of a global agenda to address poverty, hunger, disease, lack of access to basic education, environmental degradation and discrimination against women. The second goal is to "achieve universal primary education" (see <http://www.un.org/millenniumgoals/>, accessed 31st August, 2006).
- [4] Puamau, P. (2005) 'Rethinking education reform: a Pacific perspective', paper presented at the conference *Redesigning pedagogy: research, policy and practice*, National Institute of Education, Nanyang Technological University, Singapore

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