

THE CONTEXT OF CULTURE: CURRICULUM STUDIES IN  
MATHEMATICS FOR ABORIGINAL-AUSTRALIAN TEACHER  
EDUCATION STUDENTS.

By Ron Stanton\*

**Introduction**

Beth Graham, in her innovative study on language and mathematics<sup>1</sup> in the Aboriginal classroom, concludes her review of the literature in the field as follows:

It seems then, that traditionally oriented Aboriginal children bring with them to school their own particular system of Aboriginal knowledge which has been learned through informal learning-through-living strategies. If these children are to retain their mother tongue and their strong sense of Aboriginal identity, this traditional Aboriginal knowledge needs to be part of their schooling experience. However if these children (or their parents on their behalf) wish to have access to the power inherent in the dominant society they will also need to gain control of the skills and understandings inherent in the M.T. culture<sup>2</sup>, which for a variety of reasons ..., will ultimately need to be talked about in English. This knowledge it seems, if it is to empower learners, needs not only to be remembered but should be socially constructed through the use of language about experiences that make both the mathematical meanings and the underlying purpose of the activity explicit to the learner.

(Graham 1986, pp 17-18)

Pam Harris warns however that

If our schools are set up for the express purpose of transmitting the M.T.

---

*\* Ron Stanton is a lecturer in maths and science in the Teacher Education program at Batchelor College.*

*1. In this paper where appropriate Mathematics with a capital 'M' refers to the mathematics of the M.T. or Western culture while small 'm' mathematics is to do with pan-cultural perspectives, the so-called mathematics.*

*2. See Bishop (1985) for the Mathematico-Technological (M.T.) culture to which Graham refers here.*

culture of the dominant group, and our purpose in mathematics lessons is to share mathematical meanings between teacher and pupils, and yet there is a wide difference between teacher and pupils in their understanding of the nature of reality and the way they organise the world to find meaning in it, then the stage is clearly set for conflict and failure.

(Pam Harris 1989, p91)

Just such an eventuality was documented by Graham as an outcome of her study of Mathematics lesson texts in English taught by non-Aboriginal teachers to Aboriginal children (Graham 1986).

In commenting on such study of Mathematics lesson texts through a notion of 'curriculum genre' (F. Christie 1985), Helen Watson notes that "There is a serious mismatch between features of conventional mathematics lessons and the features which would best serve the purposes of learners in Aboriginal schools (autonomous bicultural learners who prefer the oral mode of communication). Experiment and innovation to reduce the degree of mismatch will most effectively be carried out by Aboriginal teachers themselves as members of reflective and experimenting communities" (Watson 89).

As Lanhupuy has argued "In all cases it will be Aboriginal teachers who will be exploring new forms of educational practice. These Aboriginal teachers will develop curriculum and teaching approaches that ... are uniquely Yolngu, while incorporating those elements of Balanda knowledge and culture needed to function in modern Aboriginal communities and in the broader Australian context. In this sense, a bicultural or 'both ways' education for Aboriginal children will emerge" (Lanhupuy 1987, p34).

In the Northern Territory the majority of these Aboriginal teachers are likely to be graduates of Batchelor College. In order to be teachers of Western Mathematics they will need to have had a thorough induction into the Mathematico-Technological (M.T.) culture (Bishop 1985). This must be considered problematic for traditionally oriented Aboriginals whose first language does not have the lexico-grammatical systems that encode M.T. technological meanings and relationships (Bishop 1985, Watson 1989). But further, what is historically conceived of as the content of school Mathematics can be considered as simply the technological component of the M.T. culture (Bishop 1988). If this technological component is to be understood and mastered the learner must

recognise, if not accept, the ideological, sociological and sentimental components "which provide what Malinowski (1923) would have referred to as the 'context of culture' " (Graham 1988, p9).

### **Problems with the 1985 Mathematics Curriculum**

It is with regard to such cultural concerns that the new mathematics curriculum strand differs markedly from the personal development Mathematics strand of 1985. That curriculum is considered by staff to be highly problematic. It is content oriented, focussing narrowly on the technological component of Mathematics from a formalist viewpoint, and devoid of the meaning-making perspectives of a cultural schema. Such a curriculum must be considered disempowering for Aboriginal students. A number of critical and research studies have drawn attention to these issues and have made suggestions as to how the mathematics curriculum within the Teacher Education program might be made more accessible for students (Davies 1989, Howe 1988, McMahon 1988, Watson 1988 1989, White 1988). Stanton (1989b) for example presents 16 recommendations dealing with expressed Aboriginal expectations, philosophic principles and trialled strategies that should be taken into account in rewriting the mathematics curriculum.

The curriculum model most influencing this program is that of Bishop, a Professor of Mathematics Education at Cambridge University who has worked in both Papua New Guinea and Australia. His model is elaborated in the book "Mathematics Enculturation" (Bishop 1988). In this he identifies two growing problem areas under which many of the questions about current directions in mathematics education world-wide may be grouped. "The first is a concern felt in many countries about the direction which mathematics education should take in the face of the increasing presence of computers and calculator-related technology in society. The second problem area concerns children whose home and family culture does not fully resonate with that of the school and the wider society, be they in London, in Aboriginal Australia or in a Navajo reservation" (Bishop 1988, Preface).

### **Mathematics as a Cultural Product - a Way of Knowing**

Bishop is concerned about mathematics as a way of knowing. After exploring a range of anthropological, cross-cultural and historical literature he goes on to present a "new

conception of Mathematics which both recognises and demonstrates its relationship with culture - the notion of mathematics as a cultural product, the environment and societal activities which stimulate mathematical concepts, the cultural values which mathematics embodies - indeed the whole cultural genesis of mathematical ideas." (Bishop 1988, Preface). In the second part of his book he goes on to elaborate on the implications such a cultural approach has for mathematics curriculum, the teaching process and teacher preparation.

### **Problems With Technique Oriented Curriculum Models**

He begins by expressing concern about the current type of Mathematics curriculum which exists in most countries in the world, and which is directed towards the performance of techniques. "Arithmetical computation is entrenched as the basis of the Mathematics curriculum, with the 'four rules' gradually being developed to handle more and more complicated 'numbers' - natural, integer, fractions, decimals, complex and, later, matrices and vectors... The technique curriculum is a curriculum of procedures, methods, skills, rules and algorithms which portrays mathematics as a 'doing' subject. Mathematics is therefore not portrayed as a reflective subject. It is not a way of knowing... (but) purports to develop a comprehensive and wide-ranging 'tool-kit' for the user. ... and development in terms of this curriculum means mastering an ever more complex and wide-ranging set of techniques. It leads logically to the notion of 'mastery' which is becoming established as the criterion of evaluation of this curriculum." (Bishop 1988, p 7-8).

"But 'technique-performance' is ... what calculators and computers can do, ... They are technique-handlers par excellence - and... one simple criticism of the technique curriculum is that it is merely developing in humans the ability to do what calculators and computers can do faster and more accurately... Surely what is needed now is more understanding and critical awareness of how, and when, to use these mathematical techniques, why they work, and how they are developed? This requires not only much greater thought, but also a different kind of thinking and therefore it requires a very different approach to the curriculum" (Bishop 1988, p 8).

### **A Technique Oriented Curriculum Cannot Educate**

An opinion often expressed is that the mathematics curriculum for Aboriginal children

should be preparing them in the techniques that they will need in order to take over the key positions within their community, and that trainee teachers will therefore need to have 'mastery' over these techniques in order that they can teach them 'effectively'. But Bishop (1988, p8) points out that "... in general, as studies such as Fitzgerald's (1981) show us, specific jobs usually require specific and well- established techniques. Business, commerce and industry are too economically controlled to allow for the average employee to experiment with her (sic) 'bag of tools'." And one might add that techniques over time change with technological advances, so a technique taught a child in school today will most likely be superseded by the time employment age is reached. According to Bishop "A technique curriculum cannot help understanding, cannot develop meaning, cannot enable the learner to develop a critical stance either inside or outside mathematics. In my opinion a technique curriculum therefore cannot educate. It can only instruct and it can only train, provided that it is successful, but however successfully it does those things it cannot, by itself, educate... For the successful child it is at the best training, for the unsuccessful child it is a disaster. "(Bishop 1988, p8-9).

### **The Need for Creative Change**

If such comments are pertinent to dominant culture children, just how disastrous must it be to the tribal Aboriginal child learning English as a second language, and trying to make sense of the 'tool box' of techniques being drilled in the Mathematics lesson. It is little wonder that teachers and students in community schools come to ritualise lessons as a means of coping, as found by Christie in 1984, and that, in a study of girls in post primary school, Stanton (1989) found that problem solving in mathematics was conceived of as ritual symbol manipulation and algorithm doing.

It should be clear by now that the concerns expressed to the Council of Batchelor College by Kath Phelan, Deputy Secretary TAFE of NTDE, about the lack of improvement in mathematical standards in Aboriginal schools, and the need to "make sure that teachers are well prepared in Mathematics, so that Aboriginal children can in turn do well in Mathematics", will not be addressed by simply more rigorous application of current curriculum and teaching practices. It is time to be creative in seeking new ways in which the mathematics curriculum can be construed and evaluated; ways which demystify and make Mathematics accessible to Aboriginal teacher and child alike; ways which allow the Aboriginal community to co-opt Mathematics, its symbolic technology and machines, for their own purposes. The new curriculum is an attempt to travel some way

down that path.

### Mapping the New Mathematics Curriculum

The curriculum organising map, as freely adapted from Bishop, is set out in Table 1. This schema can be seen to be consistent with the Batchelor College experience and the writings of Graham and Harris, particularly with regard the Societal and Cultural components. The numbering does not imply sequencing, though in the Societal case it does follow the time frame advocated in the Community Studies Strand of the Batchelor College Teacher Education Program.

**Table 1.** Mathematics curriculum organisation map: freely adapted from **Bishop (1988)**

COMPONENT	SYMBOLIC	SOCIETAL	CULTURAL
A			
C	1. Counting	1. Current situation	
T	2. Locating	2. Historical issues	1. Pan-cultural
I	3. Measuring	3. Contemporary perspectives	2. Aboriginal culture
V	4. Designing	4. Future directions	3. Mathematics culture
I	5. Playing		
T	6. Explaining		
I		Develops critical awareness of the development of maths values in society.	Math as a culture and maths ideas as invention by all cultures.
E	Learned through activities in an environment context.		
S			
VALUES:	<b>Rationalism/Objectivism</b>	<b>Progress/Control</b>	<b>Openess/Mystery</b>

### Curriculum Organising Activities

The most obvious way in which the new mathematics curriculum looks different from the 1985 version, and from the 'standard' techniques oriented curriculum, is that it does not consist of a list of techniques, sequenced in terms of an arbitrary hierarchical structure. Instead the techniques may be found subsumed under the notion of six component Symbolic 'activities' that Bishop proposes are found across all cultures (Bishop 1988, pp 22-23). These are set out in Table 1 as counting (How many?), measuring (How much?), locating (Where?; When?; Who?), designing (What?), playing (How?) and explaining (Why?). Not all would agree that these activities are a valid way to look for mathematical commonalities across cultures. For example Helen Watson

cautioned in a letter to the course development committee that because of Bishop's very limited experience of non-Western cultures he has been led "... into a serious mistake in identifying the level of abstraction at which one might search for mathematical commonalities across cultures." (Watson 1989, letter). However these 'activity' notions are very helpful in structuring the curriculum, and one study has shown that when a group of Aboriginal teacher education students classified English words and phrases used in an art activity for mathematical meanings, the classifications arrived at were very close to those of Bishop (Stanton 1989b).

### **Negotiating the Curriculum Through 'Activity' Foci**

Even more importantly, the adoption of some form of 'activity' focus is essential if the mathematics curriculum is to truly facilitate the implementation of Batchelor College principles to do with negotiation of the curriculum. It is difficult to imagine how a techniques oriented curriculum could be the subject of real negotiation given that it depends on a knowledgeable expert training inductees into correct procedures that must be mastered. The 'activity' foci suggested by Bishop thus have value in that they allow the learning team (lecturer and student) to stand outside the minutiae of algorithm practice and look at general mathematical principles and the associated values. According to Bishop (1988, p 100) "they are offered as organising concepts in the curriculum which provide the knowledge frame. They should be the foci of concern, approached through activities in rich environmental contexts, explored for their Mathematical meaning, logic and connectedness, and generalised to other contexts to exemplify and validate their explanatory power". This is the principal way in which the foci are used within this curriculum. In each semester unit at least one of the 'activities' of Bishop is given focus of attention, so that by the time four years are completed each 'activity' will have been addressed at least once and so the field of Mathematics of the M.T. culture will have been covered. In actual fact, because of the integrated nature of the program key concepts will be revisited many times in many contexts.

### **Research into Traditional 'Activities'**

Another of the major benefits of adopting this structure is that it enables what Helen Watson calls the 'big picture' of mathematics to be made explicit. The 'activities' provide focus issues for community research that have implications in the development of Aboriginal mathematics pedagogy. The use of the 'activities' in this way should not prove problematic since students will be researching within their own community, in

their own languages. They would look at, for example, how their people traditionally locate in space, time and society and the use of recursion in kinship schema. Whether or not they may come to identify bridges between their own cultural ways of knowing and that of M.T. Mathematics will be subject to their own professional judgement. It certainly makes more sense than looking at Aboriginal culture for examples of how inequations are traditionally applied.

In support of the notion of such research Bishop (1988, p 41) draws attention to the work of Gerdes (1986) in which examples are given of mathematical ideas inherent in the design work of Mozambican artisans. It is argued strongly that this mathematical work be recognised in their school curriculum in order that "By unfreezing this frozen mathematics, by rediscovering hidden mathematics in our Mozambican culture, we show indeed that our people, like every other people, did mathematics" (Gerdes 1986 p. 12). By providing opportunities for Aboriginal teachers to do similar investigations within their own culture, the stage is set for Aboriginal Australia to identify with, co-opt and use Mathematics.

### **Calculators and Computers**

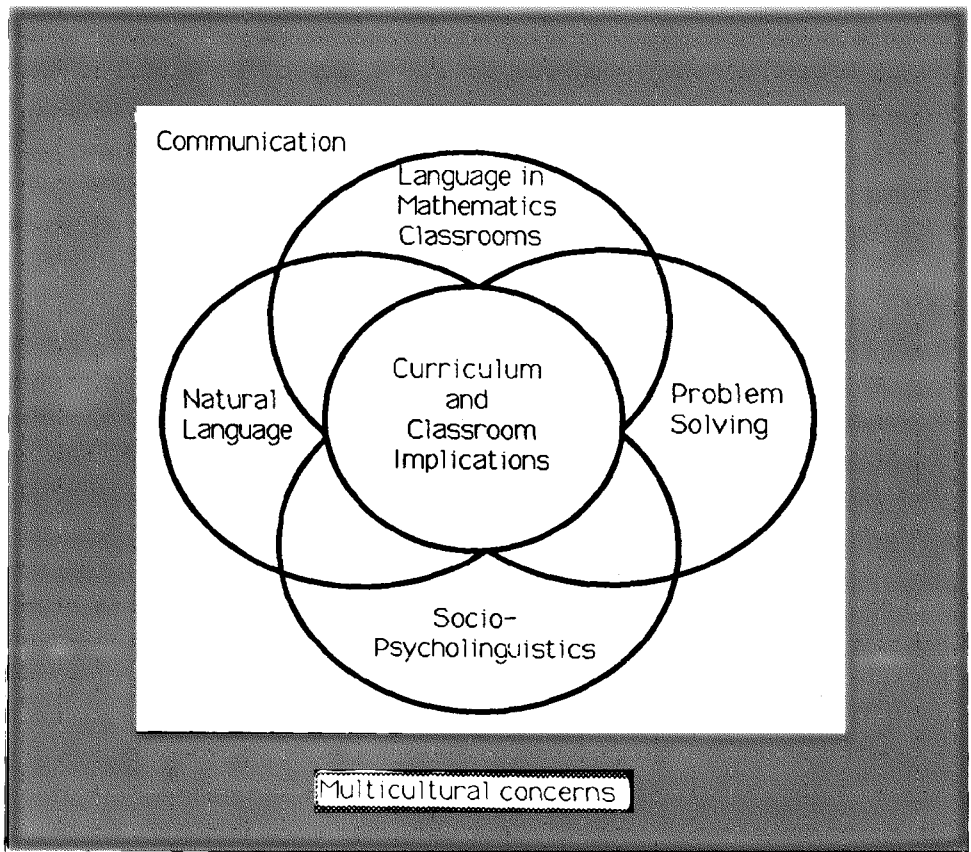
The first key area of world-wide concern identified by Bishop is that of the place of the technology of calculators and computing in mathematics education. This issue has linkages across the curriculum map, intersecting not only the Symbolic but also Societal and Cultural components. It also calls attention to the notion of conflicting values between traditional and M.T. culture and asks how a workable and acceptable balance may be negotiated, between Progress and Control for example. This technology is highlighted each semester as students are taken through the program, from basic calculator techniques and computer games to the use of spreadsheets and data bases, integrated with other ongoing activity of course.

This must be seen as an essential part of any mathematics curriculum that presents mathematics as a cultural way of knowing, as opposed to a purely technique mastery training program. The inclusion implies that there be a strong support policy with regard to the provision of the necessary machines and software both at Batchelor College and in community schools, through the Education Department.



**The Interface Between Language and Mathematics**

As a sign of the times, the June 1989 edition of the Australian Journal of Reading devoted the entire contents to a focus on "Language in Mathematics". The guest editor Jennie Bickmore (1989) notes in the editorial that "A strong following exists around Australia for the adoption of the language in math's philosophy that has arisen from the work of Graves (1983) and Cambourne (1987). Teachers are applying Cambourne's conditions of language learning together with process writing and conferencing to their mathemat-



**Figure 1.** The interface between mathematics and language (adapted from Ellerton 1989, p. 93)

ics classrooms ... The Bruner (1976) and Vygotskian (1978) perspectives of **scaffolded learning** signal a shift in pupil-teacher relationships ... maths is processed as a social as well as an individual construction of meaning, with language playing the key role. Mathematics too has altered its direction... The shift is toward a more constructivist mode where classes jointly construct meaning from their mathematical situations." (Bickmore 1989, p. 85)

Ellerton, one of the key contributors to the above volume, is concerned that while much has been written recently about mathematics and language most address specific issues which appear interrelated in obscure and complex ways. What is lacking is a satisfactory theoretical model which might facilitate discussion about the interface between mathematics and language. One possible way of representing this interface is put forward in Figure 1, as adapted from Ellerton (1989). It appears to be a good model for use within the context of the Batchelor College Teacher Education Program. The only change I have made in the model is that 'Psycholinguistics' be prefixed by 'Socio-' in recognition of the work done in this field by Beth Graham (1986) and others.

### **Language/Mathematics Interfaces and Action Research**

This curriculum thus recognises that mathematics lessons are essentially linguistic exercises and that if it is the Mathematics of the M.T. culture that is the focus of the lesson then the text of that lesson will be in English or if not then will depend in some way upon the logico-grammatical schema of that language. For the students of Batchelor College, especially those from the more traditionally oriented communities, English is a second, or even third or fourth language. These students will be working with children learning Mathematics at the same time as they gaining a working useage of English as a second language. There are no text books that pretend to teach how this may be done. This teacher education mathematics curriculum thus proposes that there be a strong **action research base** to the practicum component in which students address the complex issues to do with the interfaces between English language, Aboriginal languages and Mathematics in the classroom. It is suggested that the model advanced in Figure 1 might be one way organising thoughts about such endeavours.

### **The Importance of Context in Learning Mathematics**

One of the fundamental principles upon which the Batchelor College Teacher Education Program is based is that of integration across the curriculum. This is important in the

mathematics component, not just as a theoretical issue, but because mathematical meanings are only made in some cultural context. Beth Graham's (1986) studies have shown the drastic effects on learning when decontextualised activities dominate the Mathematics classroom. The new curriculum therefore makes explicit that there will be very little scope within the program for 'Mathematics lectures' or even 'Mathematics classes' for to advocate such would be inconsistent and contrary to the very philosophy that drives the program.

Instead it is expected that in virtually all learning and researching, where appropriate, the mathematics involved will be made explicit and its power in use as an intellectual tool and way of knowing will be explored. In this way not only will mathematics be addressed in context, but facility with techniques and procedures will be treated formally on what might be termed 'a need to know' basis. In other words students will learn techniques and procedures as they identify for themselves a need to master a particular problem. This might arise in the context of a workshop, or simply be the outcome of a student recognising that a Mathematical technique needs to be better understood and rehearsed so it can be used effectively in the classroom. This is where strong tutorial support must be available with access to expertise and other resources.

### **A Workshop Driven Approach to Curriculum**

While the above makes good pedagogical sense for adult learners, all is not left to chance. Throughout the program techniques, procedures and concepts are identified for specific treatment as subsumed under the 'activity' foci of Bishop (1988). One 'activity' is identified as the mathematical orientation driving at least one **major workshop each semester**. The workshop will be explicitly named for the Mathematics being addressed, and will allow for activity sufficient to allow conceptual understanding and for rehearsal of the essential language involved. All other workshops will provide for the integration of mathematics, and how the mathematics is being used will be made explicit. Workshop outcomes will generate mathematic issues for community and classroom research.

While each of the six 'activities' is specified for treatment at least once, a number of activities identified as fundamental in the primary school classroom are returned to again, while the 'activity of explaining' is made explicit throughout, especially where

research and activity data are being processed for sharing. The major workshops might be best thought of as "concentrated mathematics encounters" (C.M.E.) as suggested by Beth Graham (1986, p 17), which would follow the model of Concentrated Language Encounters already widely used as a teaching/learning strategy. (See *Concentrated Language Encounters in Aboriginal Schools in the N.T.* 1986 for further information.) It is possible that the Concentrated Language Encounter strategy has, at least in part, contributed to the "some improvement in English" in Aboriginal schools noted by Phelan (1989). If so adoption of the strategy in mathematics education might work.

### **Lasting Change in Classroom Behaviours**

At this point the biography of the student needs to be accommodated if there is to be a chance that there will be change in the behaviour of teachers in the community school classroom. As Pateman (1988) has pointed out with reference to the M.T. culture, that while teachers may be trained to present mathematics in new and interesting contexts that follow social-constructivist approaches, they are frequently coerced by peer pressure and the 'hidden curriculum' into returning to the old technique-oriented strategies consistent with the way they themselves were taught in school. The majority of Batchelor College students will have had 'bad' Mathematics experiences in their time at school. The model they bring with them will almost certainly have a technique mastery orientation that involves perspectives associated with the 'empty vessel to be filled', 'handicapped learner', 'algorithm doing' syndromes. These students will have experienced failure in school and they will exhibit a deeply entrenched apprehension about Mathematics. Those students who have experienced some success in technique mastery in school expect more of the same and to go into schools and 'do it' to the children there.

In both cases there are problems that the curriculum needs to address. These revolve around issues to do with overcoming the fear, demystifying mathematics, re-orienting attitudes and expectations about classroom mathematics, and engendering at least aspirations of control over 'this thing' called mathematics. The way through can only be expected when students begin to experience the fun and aesthetic of mathematics, the appreciation of the values involved, the access to power of explanation that mathematics provides, and the satisfaction that comes from being in a position to liberate the minds of the children beyond the limits of classroom ritual.

### Summary

The new curriculum demands that any exposure of students to mathematics be made explicit, and be cast in terms of its place in the 'big picture'. It must engender feelings of joy and control while not avoiding the intellectual 'pain' of prolonged engagement with difficult conceptualisations. It must be cast in contexts that have meanings that are generalisable and pervading. It must provide insights that promote appreciation of the schema that underlie the logico-grammatical constructs of the English language, while not making value judgements about the efficacy of Aboriginal language in making meaning over the world. It should look for and celebrate the mathematics which is to be found, in Gerdes (1986) terms, 'frozen' in Aboriginal tradition. It must make the student feel comfortable with, and an apostle for, the co-opting of Mathematics to Aboriginal purposes. This curriculum assumes that enough time within the program will be made available for the particular Mathematical registers of the English language to be made explicit and rehearsed. At least one workshop per semester will be explicitly oriented towards issues to do with mathematical enculturation.

### Conclusion

The whole field of mathematics education is complex in the extreme and in a state of flux worldwide. Old paradigms driven by 'technique mastery' values have been found inadequate and replacements are being sought that admit of Mathematics as a cultural enterprise within which meaning is socially constructed and condensed into dense forms of the graphic codes of particular registers of the English language. For Batchelor College students, who would be teachers of mathematics, the complexities are compounded because they, and their pupils, come from a world where meaning schema are radically different from those of the M.T. culture within which they represent a minority interest.

It is paradoxical that in order to maintain the integrity of the cultural base Aboriginal Australia must struggle for survival by taking 'on board' the meaning schema of the very technologies that in powerful ways threaten to undermine and subvert identity. Resolution of this paradox will only be achieved when means are found to co-opt Western technologies, such as Mathematics, for use by Aboriginal communities in Aboriginal ways. A progress down this path will be speeded when there are more Aboriginal teachers who thoroughly understand, if not necessarily subscribe to, the symbolic, societal and cultural dimensions of Mathematics and mathematics.

**Bibliography**

- Batchelor College** (1985), *Associate Diploma of Teaching (Aboriginal Schools)* 1985. Accredited curriculum statement.
- Bickmore, J.** (1989). 'Language in Mathematics', *Australian Journal of Reading*, 12, 2, Australian Reading Association Inc., Melbourne.
- Bishop, A. J.** (1985), 'Mathematics in Aboriginal Schools for Aboriginal Children'. A paper presented at the National Seminar on Mathematics Education for Aboriginal Children, Alice Springs.
- Bishop, A. J.** (1988). *Mathematical Enculturation*, Dordrecht, Kluwer Academic Publishers
- Bruner, J. S.** (1976). 'Early social interaction and language acquisition' in H. R. Schaffer (Ed.) *Studies in Mother-infant interaction*. London: Academic Press.
- Christie, M.** (1984), *The Classroom World of the Aboriginal Child*. Ph.D. thesis, University of Queensland.
- Davies, B.** (1989) 'An Investigation of the Mathematics Component of the Maths/ Science Strand', Batchelor College Mimeo.
- Dawe, L. C. S.** (1988), 'The Impact of Culture in the Mathematics Classrooms of Multicultural Australia' in *Cultural Dynamics* (in press).
- Ellerton, N. F.** (1989). The interface between mathematics and language', *Australian Journal of Reading*, 12, 2, Australian Reading Association Inc., Melbourne.
- Fitzgerald, A.** (1981) *Mathematics in Employment (16-18)*, University of Bath, School of Mathematics.
- Gerdes, P.** (1986) 'How to Recognise Hidden Geometrical Thinking: A Contribution to the Development of Anthropological Mathematics', *For the Learning of Mathematics* 6, 10-17
- Graham, B.** (1986a), Learning the Language of Schooling: Considerations and Concerns in the Aboriginal Context', in *Keynote Address Book of the Australia and New Zealand Conference on the The First Years of School*, Sydney.

- Graham, B. (1986b), Concentrated Language Encounters: An Approach to Language Learning with Aboriginal Children'. A workshop paper presented at the Australia and New Zealand Conference on the First Years of School, Sydney
- Graham, B. (1986c), *Language and Mathematics in the Aboriginal Context: A Study of Classroom Interactions About Addition in the Early Years*. M. Ed. thesis; Deakin University.
- Graves, D. (1983) *Writing: Teachers and Children at Work*, London, Heinemann.
- Harris, P. (1989) 'Contexts for Change in cross-cultural classrooms.' in N.F. Ellerton & M.A.Clements (eds) *School Mathematics: The Challenge to Change*. Deakin University, Geelong, Vic.
- Harris, S. (1988). 'Culture Boundaries, Culture Maintenance-in-Change, and Two-Way Aboriginal Schools'. *Curriculum Perspectives* 8 No. 2, 76-83
- Howe, Peter (1988), *Report of Professional Development Maths/science, Batchelor College 19th-25th August, 1988*. Batchelor College, NT.
- Kemmis, S. (1988). *A study of the Batchelor College Remote Area Teacher Education Program 1976-1988*. Geelong, Victoria: Deakin Institute for Studies in Education.
- Lanhupuy, W. (1987). Occasional address at the Deakin University ceremony for the presentation of batchelor of Arts in Education degree testamurs to successful 1986 D-BATE students, Batchelor College Thursday June 4.
- Livett, G. (1987). *An Approach to Teaching the Math/Science Strand - A RATE View*. An information statement for the Maths/science strand, Batchelor College, NT.
- McMahon, K. (1989). *Action Research and the Critical Analysis of Pedagogy*. To be published in Stage 2 RATE Evaluation Report by Yirrkala Community School Action Group, Ed. Yinupingu et al: Yirrkala NT.
- McTaggart, Robin (1988). 'Pedagogical Principles for Aboriginal Teacher Education'. *The Aboriginal Child at School*, 15(4) 21-33.
- McTaggart, Robin (1989). 'Aboriginalisation Implies Empowerment and Disempowerment'. *The Aboriginal Child at School*, 17 (2) 37-44
- Malinowsky, B. (1923) 'The Problem of Meaning in Primitive Languages, Supplement 1, in Ogden, C. K. and Richards I. A., *The Meaning of Meaning*, (The International Library of Philosophy, Psychology and Scientific Method, Kegan Paul, London.

- Matjarra, Manydjarri, Warmbirrierr & Djambutj** (1986) 'What we think', in D. J. McClay, S. Harris and M. Christie (eds) *Teaching in Arnhem Land*.
- Menninger, Karl** (1969). *Number Words and Number Symbols: A Cultural History of Numbers*. Translated by Paul Broneer from the revised German edition: MIT Press. Cambridge, Mass.
- Northern Territory Department of Education** (1988). *Mathematics in Aboriginal Schools (Stages 1,2 &3)*. Distance Education Branch, NT Dept. of Education, Darwin, NT.
- Northern Territory Department of Education** (1986) *Handbook for Aboriginal Bilingual Education in the Northern Territory*, Darwin.
- Pateman, N.A.** (1989). *Teaching Mathematics - a tantalising enterprise: On the nature of mathematics and mathematics teaching*. Geelong: Deakin University.
- Phelan, K.** (1990). *Submission Paper to Batchelor College Council*. Meeting 2/90. Batchelor College Mimeo
- Poulson, Chris Japangardi** (1988). 'The School Curriculum I Would Like For My Children'. *Curriculum Perspectives* Oct. 1988 Vol. 8, No.2.
- Stanton, R.** (1989a). *Cultural Health and the Math/Science Diet*. Discussion paper for the Mathematics and Science Strand, Batchelor College, NT.
- Stanton, R.** (1989b). *Mathematics and Science Studies: Where are the Foundations?*. A discussion paper, Batchelor College, NT.
- Stanton, R.** (1989c). *Mathematics, Language and Art Workshop Report*. A draft report. Batchelor College Mimeo.
- Stanton, R.** (1989d) '*The Mathematics Curriculum - A Critical Evaluation*': Batchelor College Mimeo.
- Vygotsky, L. S.** (1978). *Mind in Society: The development of higher psychological processes*. Cambridge: Harvard University Press
- Watson, H.** (1989a). Letter to the Convenor, Teacher Education Committee, Batchelor College, 18th April 1989.
- Watson, H.** (1989b). 'Language and Mathematics Education for Aboriginal- Australian Children'. *Language and Education* 2(4) 255-73.
- Watson, H.** (1988a). *A Wittgensteinian View of Mathematics: Implications for Teachers of Mathematics*. Paper presented to Mathematics Education Research group of Astralasia Conference, Deakin University





## NGOONJOOK

- White, L.** (1988). *The beginning of change: The organisation and operation of Homeland Centre Remote Area Teacher Education in the North East Arnhem Region*. Batchelor, NT: Batchelor College.
- Wilder, R. L.** (1981) *Mathematics as a Cultural System*, Pergamon Press, Oxford.
- Wunungmarra, W.** (1988). "‘Dhawurrpunaramirra’ Finding the Common Ground for a New Aboriginal Curriculum". *Curriculum Perspectives* Vol.8 No. 2.
- Yunupingu, M.** (1988). *A plan for Ganma research*. Mimeo, Yirkala Community School.

**Ron Stanton, 1990**

AIATSIS Library, **S 37.7/15**

“The context of culture; curriculum studies in mathematics for Aboriginal-Australian teacher education students” (m0008314\_v\_a.pdf)

To cite this file use:

[http://www.aiatsis.gov.au/lbry/dig\\_prgm/e\\_access/serial/m0008314\\_v\\_a.pdf](http://www.aiatsis.gov.au/lbry/dig_prgm/e_access/serial/m0008314_v_a.pdf)

© Ron Stanton